Ministry of the Environment
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The FEASIBLE Model, Version 2

User Manual and Documentation

January 2004

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List of Abbreviations and Acronyms

C&D	Construction and demolition
CEE	Central and Eastern Europe
CIS	Commonwealth of Independent States (of the former Soviet Union)
CSS	Combined sewerage system
DANCEE	Danish Cooperation for Environment in Eastern Europe
EAP	Environmental Action Plan
EFS	Environmental financing strategy
EU	European Union
EUR	Euro
FEASIBLE	Financing for Environmental, Affordable and Strategic Investments that Bring on Large-scale Expenditure
GDP	Gross domestic product
GRP	Gross regional product
HH	Household
HHW	Hazardous household waste
HHWTF	Hazardous household waste treatment facility
ID	Identification
IFI	International financing institutions
ITT	Intake, transmission and treatment
ldc	Litres per capita per day
MRF	Materials recycling facility
MSW	Municipal solid waste
NIS	Newly independent states (of the former Soviet Union)
OECD	Organisation for Economic Cooperation and Development
OM	Operation and maintenance
RD	Research and development
SMART	Specific, measurable, agreed, realistic and time-bound (policy targets)
UMS household	Urban, multi-storey household
USF household	Urban, single-family household
WEEE	Waste electrical and electronic equipment

WW	Wastewater
WWTP	Wastewater treatment plant

1 Introduction

This is the user manual and documentation of FEASIBLE - a software tool developed to support the preparation of environmental financing strategies for water, wastewater and municipal solid waste services in the CIS and CEE regions.

Although the environmental financing strategy methodology and the supporting FEASIBLE decision support tool were originally developed primarily in a CEE/CIS context, the methodology and FEASIBLE are equally applicable in developing countries.

The environmental financing strategy concept

An environmental financing strategy is a methodological framework for medium- to long-term strategic balancing of environmental and service targets with the future available financing in the environmental sectors that require investment-heavy public infrastructure. The methodology was developed by the OECD EAP Task Force with Danish support.

FEASIBLE

The practical implementation of the methodological framework is supported by a computerised decision support tool, called FEASIBLE. The tool facilitates the iterative process of balancing the required finance with the available finance.

The name FEASIBLE abbreviates Financing for Environmental, Affordable and Strategic Investments that Bring on Large-scale Expenditure.

The key feature of FEASIBLE is the use of generic expenditure functions. These expenditure functions allow easy estimation of the expenditure needs of alternative service and environmental targets with a limited data collection effort.

FEASIBLE uses as input a description of the existing environmental infrastructure and the availability of finance from user charges, public budgets and other sources. Based on a specification of the future service level targets and a projection of the available future finance, the model quantifies the resulting gap between the demand for expenditure (to invest in, operate and maintain infrastructure) and the supply of available funds. FEASIBLE can then play an important role in providing an assessment of how alternative policies will affect the financing surplus or deficit.

The first version of FEASIBLE, a spreadsheet based version for water and wastewater, was released in 2001. The new version, FEASIBLE Version 2, which is the object of the present manual, is a stand alone application based on a database. The main improvements in comparison with the first version are the inclusion of the municipal solid waste sector and improvement of the user interface and scenario handler.

FEASIBLE has been developed by COWI in close cooperation with the OECD and financed by DANCEE.

Target groups

The manual provides guidance on the use of FEASIBLE in the preparation of environmental financing strategies, and it documents the generic expenditure functions applied by FEASIBLE for environmental infrastructure operations, maintenance and investment.

The direct users of FEASIBLE will mainly be interested in the main text of the user manual but may refer to the appendices for additional information on the expenditure functions underlying the model. Such users will typically be staff and external consultants of ministries of environment and ministries responsible for municipal services as well as donor countries and IFIs.

The manual also provides documentation for technical staff of the beneficiary ministries as well as experts external to the users in order for these groups to be able to assess the validity of the results generated by FEASIBLE. In particular, the appendices explain in detail how the expenditure needs functions have been constructed and validated, and how they should be calibrated for use in specific countries. Such knowledge may be used to assess the validity of the quantitative information presented in the environmental financing strategies.

It should be noted that proper use of FEASIBLE and interpretation of model results require extensive knowledge of the technical and financial aspects of the sectors analysed as well as familiarity with computers. Hence, in some countries, local consultants and staff of beneficiary ministries will need to be trained in the use of the model to be able to apply it appropriately.

Acknowledgements and disclaimer

The principal authors of this manual are Mr. Michael Munk Sørensen, Mr. Jørgen Jordal-Jørgensen, Ms. Birgitte Martens and Mr. Carsten Glenting, COWI.

The overall design of the model, which has been developed based on the first version of model, has been the responsibility of Mr. Michael Jacobsen and Mr. Michael Munk Sørensen, COWI.

The design of the user interface of FEASIBLE version 2 has been developed by Mr. Jørgen Jordal-Jørgensen and Mr. Michael Munk Sørensen. The structure of the municipal solid waste module and the associated expenditure functions have been developed by Ms. Carole Welton Kaagaard and Mr. Jonas Byström, COWI[1]. The structure of the water sector module has been designed by Ms.

[1] Contributions have also been made by Mr. Jens Bjørn Jacobsen and Mr. Niels Aagaard Jensen, COWI

Oxana Popkova Sørensen and Mr. Michael Munk Sørensen in cooperation with Mr. Allan Jakobsen (water supply expenditure functions), Mr. Jørgen Færch Knudsen (wastewater collection) and Mr. Thomas Ravn Kongerslev (wastewater treatment), all from COWI. The latter three have developed the expenditure functions for the water and wastewater module.

Mr. Jørgen Jordal-Jørgensen has programmed the municipal solid waste part, while the other modules have been programmed by EUROSOFT A/S.

The project has been followed by an advisory committee from which important comments and suggestions have been received. In particular, Ms. Ulla Blatt Bendtsen and Ms. Nina Korobova of DANCEE and Mr. Grzegorz Peszko and Mr. Ulrik Dan Weuder of the OECD.

The municipal solid waste module has been tested through applications in Novgorod, Russia and Latvia. In addition to those already mention, comments and suggestions have been made by Ms. Zsuzsa Lehoczki, COWI Hungary, and Alexander Martussevic, COWI Int. Ltd., Moscow office.

Ms. Lisbeth Moliin has provided coordination and language improvements, and Mr. Jes Frederiksen has assisted in the design and testing. These contributions not withstanding, all errors and omissions remain the responsibility of the principal authors.

The opinions expressed are those of the consultant. DANCEE (Danish Ministry of the Environment), the OECD EAP Task Force, and the beneficiary ministries are not necessarily in agreement with these opinions.

Structure of the manual

The manual is structured as follows:

Chapter 1, Introduction is the present introduction to the manual.

Chapter 2, Methodological Considerations provides a brief introduction to the environmental financing strategy methodology and describes the role of FEASIBLE.

Chapter 3, Model Overview provides a brief overview of the structure and main functions of FEASIBLE, the modelling approach with generic expenditure functions and price correction factors, as well as the available technology choices.

Chapter 4, User Manual - General Issues provides a detailed description of hardware and software requirements, model installation, pre-model analysis, minimum data requirement and the use of the general parts of the model.

Chapter 5, User Manual - Water Supply Module provides a detailed description of the use of the water supply module, including data input and results.

Chapter 6, User Manual - Wastewater Module provides a detailed description of the use of the wastewater module, including data input and results.

Chapter 7, User Manual - Municipal Solid Waste Module provides a detailed description of the use of the municipal solid waste module, including data input and results.

Chapter 8, User Manual - Supply of Finance describes the modelling of the supply of finance from user charges, public budget, grants and loans and the analysis of affordability.

Finally, **Chapter 9, User Manual - Results** provides a description of the results (technical, supply of finance, expenditure and financing gap) generated by FEASIBLE and their interpretation.

The **Appendices** provide detailed documentation of the generic expenditure functions that form the backbone of FEASIBLE.

Trained consultants and staff in the beneficiary ministries applying the model will want to read chapters 2 through 9. This group may find the appendices useful for reference. Technical staff and external experts, who want to validate model results and/or check the relevance of the assumptions of the expenditure functions for a particular country/region, will want to acquaint themselves with the appendices and chapters 2 and 3.

2 Methodological Considerations

The present chapter provides a brief introduction to the environmental financing strategy (EFS) methodology and describes the role of FEASIBLE. For a more detailed description of the EFS methodology, the reader is referred to the publications referenced at the end of this chapter.

2.1 Environmental Financing Strategies

The concept

An environmental financing strategy is a methodological framework for medium to long-term strategic balancing of environmental and service targets in the environmental sectors that require investment heavy public infrastructure with the future available financing for the same sectors.

Sector policies and programmes

Sector policies and programmes are typically based on a thorough analysis of the problems and the regulatory framework within which the programming takes place. They also identify overall priorities and long-term general objectives. In addition, sector policies and programmes often include a list of short-term emergency measures that are then proposed for immediate inclusion in the public budgets.

Shortcomings of traditional sector programmes

However, while many sector programmes and many environmental action plans (EAPs) provide a lucid analysis of existing problems and also often well-thought-through environmental objectives, the task of translating these environmental objectives into time-bound and ranked targets has proven to be more difficult. Cost-benefit analysis has very rarely been done to prioritise the targets. Furthermore, specific policy actions with costing and assigned responsibilities are often lacking. Finally, analysing and documenting how the expenditure can be financed and how targets and related financing should be phased over time have also rarely been done. As a result, many sector programmes and EAPs have been good strategy and policy statements, but not well suited to guide the implementation of a (public) investment programme.

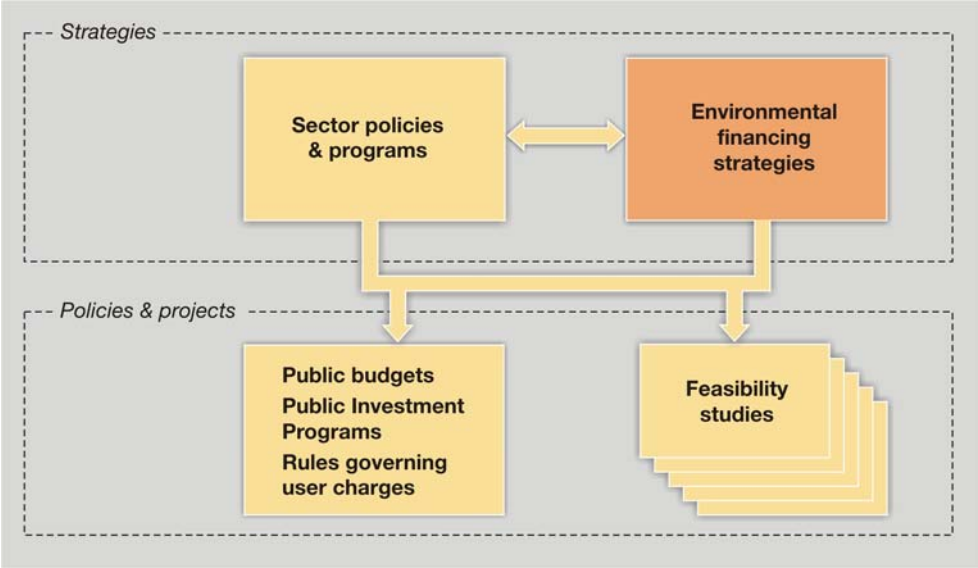
The EFS specifies expenditure need and supply of finance

The EFS concept has been designed to address some of the shortcomings identified above. The EFS is particularly intended to bring together target setting and financing of related investments. As described in more detail in the following sections, the financing strategy is prepared by analysing the expenditure needs related to the environmental objectives stated in the sector programme and by comparing these with the available supply of finance.

The environmental financing strategies hence fill a gap between sector policies that identify and analyse problems and set general long-term objectives, on the one hand, and feasibility studies, public budgeting and investment planning, on the other hand.

Figure 2-1 illustrates the position of environmental financing strategies in the general planning process.

Figure 2-1 Position of environmental financing strategies in the planning process



Financing gap

The key element in an environmental financing strategy is the comparison between expenditure need and supply of finance. The result of this comparison is the financing gap which expresses the difference (in monetary terms) between the expenditure need created by a given set of environmental objectives and the amount of finance available.

The existence of a financing gap implies that:

- the assumed future supply of finance from user charges, public budgets and donors is insufficient for the planned future environmental service level; or
- the planned future environmental service level is too ambitious in view of the available future supply or finance; or
- a combination of both.

To close the financing gap, either the policies that determine the available supply of finance, the objectives or both will have to be revised.

EFS *sensu strictu*

The development of an environmental financing strategy encompasses the systematic analysis of alternative environmental targets and financing options with the aim to achieve a set of SMART (i.e. Specific, Measurable, Agreed,

Realistic and Time-bound) targets and a corresponding set of financing proposals that will close the financing gap (i.e. causes it to be at least zero every year). Such a combined set of environmental targets and financing proposals is said to constitute an environmental sector financing strategy *sensu strictu*.

2.2 The Use of Environmental Financing Strategies

The environmental financing strategy is the result of an iterative process towards coherent and realistic planning of the future service level and the financing of the sector from user charges, public budgets, donor funds and financing mechanisms. The environmental financing strategy, therefore, provides an overview of the financing envelope for the sector and the trade-off between different service targets. Thereby, it can be used as a common frame of reference for all relevant stakeholders in the discussions and negotiations on the development of the sector.

The environmental financing strategy, furthermore, provides a framework for systematic costing of environmental targets and for aggregating the consequences for liquidity and household affordability.

Environmental financing strategies may address issues such as the sustainability of the current level of maintenance and re-investment, the affordability of full-cost-recovery user charges and the realistic time frame for service level improvements.

Financing strategies can be used by transition and developing countries to:

- Bring about down-to-earth implementation programmes given what the economy and the households can afford;
- Identify investment projects and build short- to medium-term project pipelines;
- Identify which policies and measures are necessary to ensure effective financing of these project pipelines;
- Support claims of environment and other ministries responsible for municipal services on the public budget;
- Support transition country requests for donor and IFI financing; and
- Measure and report progress in the implementation of programmes and policies.

Additional to the use in transition and developing countries, donor countries and IFIs can use the financing strategies to:

- Check if local co-financing commitments are realistic;

- Co-ordinate different donor and IFI programmes;
- Identify country pipelines of supported investment projects; and
- Provide a broader perspective for the appraisal of financial viability of individual investment projects.

2.3 The Process of Preparing an Environmental Financing Strategy

Intense dialogue is needed

An intense process of analysis, consensus seeking and communication across various groups of stakeholders in environmental protection must take place in order to prepare an environment sector financing strategy which is relevant in the local economic, social and political context.

Furthermore, local ownership of the process and the results is paramount to facilitate the practical use of an environmental financing strategy as key issues addressed will, by nature, be politically sensitive, for instance, the adequacy of present user charges and the realism of stated service level targets,.

The suggested structure of this dialogue is outlined in the following subsections.

2.3.1 Analysis of the "No-Change-in-Policy" Alternative[2]

The establishment of a sound baseline or "no-change-in-policy" alternative is crucial to any medium- or long-term analysis of sector policies and programmes. This alternative describes the future as it is likely to look if there is no change in policies and their implementation and enforcement in practice. This is not a trivial exercise, since expected changes external to the sector, such as changes in technology, macro-economic conditions, international trade etc. need to be taken into account in the definition of the baseline. However, a good "no-change-in-policy" alternative is essential to understand the need, if any, for enhanced policies.

In terms of the environment sector financing strategy, the "no-change-in-policy" alternative includes a projection of the future demand for environmental expenditure that will result from no changes in the present policies in relation to service levels, pollution control, emission standards etc. as well as a projection of the supply of finance that will result from no changes in present policies on user charges, public budget allocations, private sector finance for the environment sector etc.

[2] Note that "policy" is defined broadly to encompass the entire spectrum of policy pronouncement, enactment of laws and regulations, enforcement hereof and all practices and habits that can be said to be policy related. In some countries, enhanced enforcement of policy may constitute a significant "change in policy".

2.3.2 Targets and Policy Dialogue

In some cases, policy makers formulate goals for environment sector policies and financing from scratch. This may be said to be the case, for example, in the CIS countries that formulate national environment action plans.

In other cases, the targets are, to a large extent, externally determined, and the purpose of the environmental financing strategy is to identify and quantify policies that ensure an adequate supply of finance and, possibly, to influence the phasing of environmental expenditure. This may be the case for EU accession countries negotiating their path to adoption of the EU environmental acquis.

The demand for environmental expenditure is a function of the level of ambition of the targets, both in terms of how soon and how much (e.g. pollution abatement) is to be achieved.

The supply of finance is influenced by a large number of policies, including but not confined to policies for user charges, public budget allocations and the development of capital markets capable of offering long-term project finance.

A set of environmental targets and policies that influence the supply of finance may be combined in a scenario for which the financing gap (the difference between the expenditure need and the available finance) can be calculated.

The scenario and the resulting financing gap will then be the basis for analysis and policy dialogue on whether the policies that determine the available supply of finance, the environmental objectives or both will have to be revised.

The key value in the application of the environmental financing methodology lies in its contribution to systematise the difficult policy dialogue on targets, related environment expenditure and supply of finance policies.

2.4 The Role of FEASIBLE

FEASIBLE can be used to facilitate the iterative process of balancing the required finance with the available finance.

It provides a systematic, consistent and quantitative framework for consideration of environmental targets.

Being a computerised model, FEASIBLE may be used to analyse “what if” a certain policy is changed and to document the results hereof in a systematic and transparent manner.

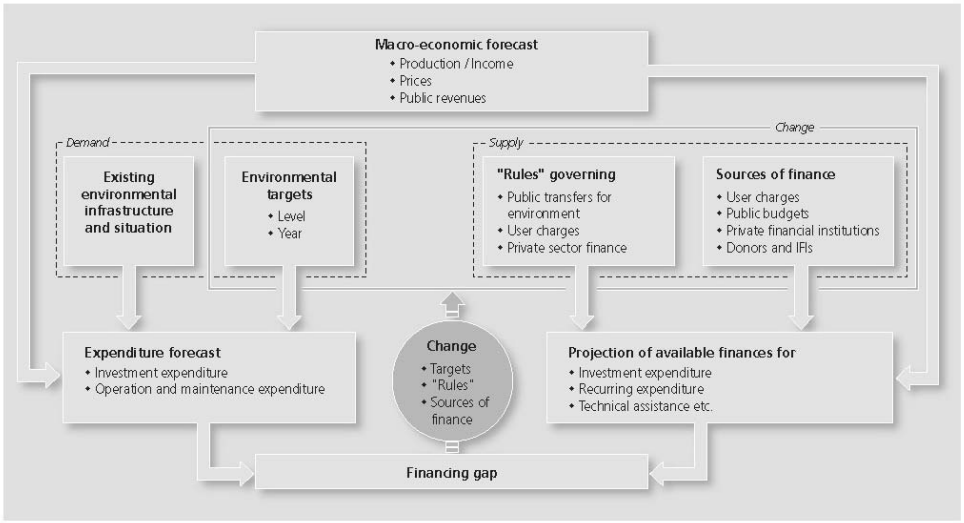
FEASIBLE is thus valuable as part of a process during which environmental and public budget policy makers consider environmental targets and the resulting implications for financing and (household) affordability.

A key feature of FEASIBLE is the use of generic expenditure functions. These expenditure functions allow easy estimation of the expenditure need of alternative service and environmental targets with a limited data collection effort.

FEASIBLE uses input describing the existing infrastructure and the availability of finance from user charges, public budgets and other sources. Based on the specification of the future service targets and projection of future finance, the model quantifies the resulting gap between the demand for expenditure (to invest in, operate and maintain infrastructure) and the supply of available funds. FEASIBLE then plays an important role in providing an assessment of how alternative policies will affect the financing surplus or deficit.

Figure 2-2 provides a schematic overview of the environmental financing strategy methodology as implemented in FEASIBLE.

Figure 2-2 Using FEASIBLE for EFS development



FEASIBLE compares the cash flow resulting from the expenditure needs with the supply of finance on a year-by year basis. In view of the results, the user can decide to establish alternative scenarios based on changed targets and/or policies for supply of finance.

The consequences of choosing alternative sets of policies (for example, move towards cost covering tariffs, changed environmental targets, etc.) may be illustrated by running a number of scenarios in FEASIBLE. Based on the results, the policy options may be refined until one or more feasible sets of policies have been found.

2.5 Interpreting Results Generated by FEASIBLE

The model provides multi-year cash flow data on expenditure and finance for one or more environment sectors at national or regional level. When determining the environmental expenditure needs, the model allows targets that are dif-

ferentiated among cities. In this way, the model makes it possible to differentiate between cities of different size categories and, in principle, also to set specific targets for one or a few cities. However, the model does not provide project level output data.

In policy terms, it is important to note that a scenario can be affordable in the long run, even if cash flow limitations make it impossible to carry out the necessary investments in the short run. Vice versa, a scenario can be financed in the short run (e.g. through debt financing), but be unaffordable in the long run. In technical terms, FEASIBLE works with cash flows, and the affordability considerations have to be made based on the long-term cash flow development.

FEASIBLE is intended as a tool to support the development of financing strategies at national or regional levels. Results are therefore shown at this aggregate level and not for individual municipalities. As expenditure need calculations are based on generic expenditure functions, they are only valid at the aggregate level. Although the model can be used to generate results for individual municipalities (by defining them as regions), it should be noted that, when it comes to individual project interventions at the local level, specific feasibility studies are necessary to determine the cost profile and possible financing packages.

2.6 Further Reading

The reader is referred to the following documents for additional information on the environmental financing strategy methodology and examples of its application in practise:

- **Financing Strategies for the Urban Water Sector in the NIS: Overview**, This paper was prepared by the EAP Task Force Secretariat (OECD) for the fifth meeting of the NIS Environmental Finance Network, 21-23 May, 2001 in Yerevan, Armenia.

- **Environmental Financing Strategies**, DANCEE/OECD, 2003

- **Extension of the FEASIBLE Model to include Municipal Solid Waste, Novgorod Case Study Report**, DANCEE, December 2002

- **Environmental Financing Strategy for the Pskov Region of the Russian Federation, Policy Paper**, DANCEE/OECD, October 2001

- **Municipal Water and Wastewater Sector in Moldova, Environmental Financing Strategy submitted to the Government of the Republic of Moldova**, DANCEE/OECD, July 2000

3 Model Overview

This chapter provides a brief overview of the structure and main functions of FEASIBLE, the modelling approach with generic expenditure functions and price correction factors, as well as the key parameters available for description of service level and target setting. For a detailed description and user guidance to the individual parts of FEASIBLE, please refer to the subsequent chapters.

3.1 Structure and Main Functions

FEASIBLE Version 2 enables analysis of the following sectors:

- Water supply
- Wastewater collection and treatment
- Municipal solid waste management

The model is structured in four main components:

- **General,** which contains the definition of the geographic area covered with its subdivision into regions, municipalities and groups of municipalities and the basic macro-economic data underlying the model scenarios.

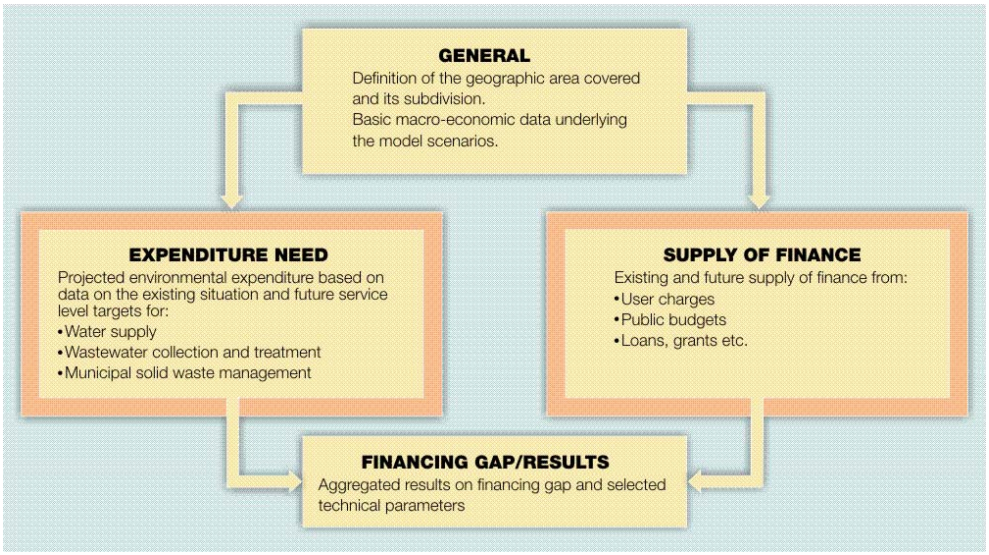
- **Expenditure need**, which calculates the projected environmental expenditure (for operation and maintenance, re-investment, renovation and new investments in environmental infrastructure) based on data on the existing situation and service level targets entered by the user.

- **Supply of finance**, which describes the existing and future supply of finance from user charges, public budgets, loans, grants etc.

- **Financing gap/results**, in which aggregated results on financing gap and selected technical parameters are calculated.

These components are composed as illustrated in Figure 3-1 below. Each component is described in sections 3.2 to 3.5 below.

Figure 3-1 Structure of FEASIBLE


GENERAL
Definition of the geographic area covered and its subdivision.
Basic macro-economic data underlying the model scenarios.
EXPENDITURE NEED
Projected environmental expenditure based on data on the existing situation and future service level targets for:
•Water supply
•Wastewater collection and treatment
•Municipal solid waste management
SUPPLY OF FINANCE
Existing and future supply of finance from:
•User charges
•Public budgets
•Loans, grants etc.
FINANCING GAP/RESULTS
Aggregated results on financing gap and selected technical parameters

3.2 General

In FEASIBLE, data may be entered and scenarios run at various levels. Before collecting and entering data, it is important to consider the analytical dimensions available. Below, a short summary of these dimensions is provided. For a detailed description, including how to select chosen dimensions in FEASIBLE, please refer to chapter 4.

Geographical delineation

Within the total area covered (a country or large region), FEASIBLE enables entry and analysis of data relating to regions, municipalities and groups of municipalities.

- **Area** denotes the total area, which is to be analysed using FEASIBLE (typically a country of a region);
- **Region** denotes a geographical subsection within the total area
- **Municipality** denotes a geographical subsection within a region (may be individual municipalities or groups of municipalities which are categorised according to size).

Planning period

FEASIBLE can operate with planning periods of 10 or 20 years.

Currency

FEASIBLE operates with EUR as the basic currency. Other currencies and corresponding exchange rates can be defined by the user.

Scenario

FEASIBLE enables the user to distinguish between and compare scenarios. Scenarios may differ in e.g.:

- The projection of expenditure need
- The projection of supply of finance
- The forecast of macro-economic and demographic parameters

Macro-economic forecast

FEASIBLE requires basic macro-economic and demographic data and forecasts in order to estimate the expenditure needs. The user is required to enter data concerning:

- Population
- GDP
- Private consumption

Price correction factors

The underlying calculations of the model are in international prices, and a set of price correction factors is used by FEASIBLE to convert results from international prices to local prices. The user is therefore required to enter data concerning the local cost of key cost components such as land, power, fuel, labour, equipment, building materials, etc.

3.3 Expenditure Need

In this component, FEASIBLE calculates the projected expenditure need based on data on the existing situation and targets entered by the user.

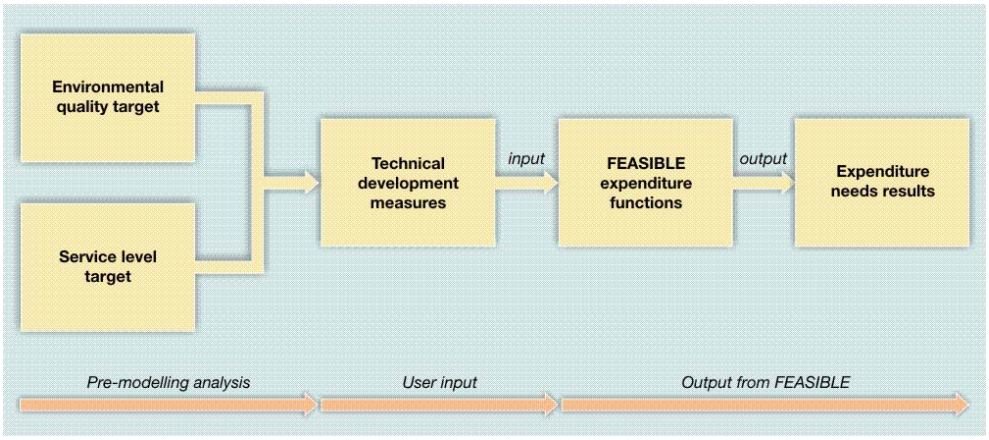
Generic expenditure functions

FEASIBLE calculates the expenditure needs based on a number of generic expenditure functions which are incorporated into the model. These generic expenditure functions cover a number of technical development measures within each sector. This means that the existing situation and the target situation are modelled through the selection of specific technical development measures which, in turn, are believed to lead to the fulfilment of a given target.

Pre-model exercise

A very important pre-model exercise therefore consists in translating environmental quality or service level targets to technical development measures as illustrated in the figure below.

Figure 3-2 Pre-model exercise



Hence, when modelling the existing situation in FEASIBLE, the user should select development measures which are as close as possible to those actually in force in the relevant areas (regions, municipalities or groups of municipalities, see above).

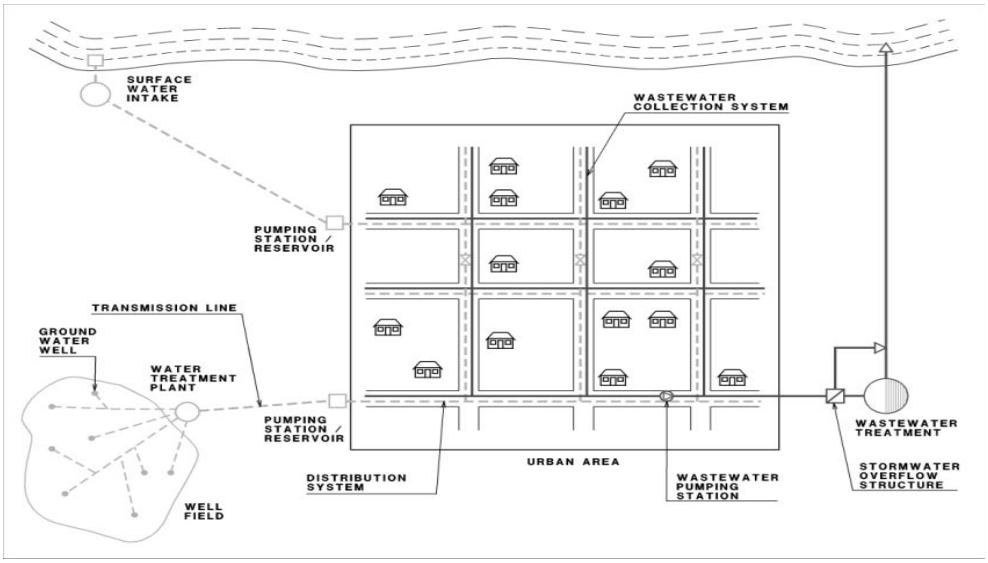
Likewise, when modelling a target, the user should select development measures which are believed to lead to the achievement of the target according to the pre-model analysis.

Below, the structure of the expenditure need component for each sector is briefly described.

3.3.1 Water Supply and Wastewater Treatment

FEASIBLE can handle both urban and rural water supply and wastewater treatment. Figure 3-3 below provides a structured view of the system in an urban area illustrating the types of development measures included.

Figure 3-3 Urban water supply and wastewater treatment technologies



The technical development measures which can be specified in FEASIBLE are listed below. For each of these, a generic expenditure function forms the basis for the calculation of the expenditure need. The expenditure functions are documented in detail in the appendices.

Water supply system - development measures

The key parameters available to describe the service level and set targets for the water supply system are:

- Type of water intake and treatment (see types in Table 3-2 below)
- Volume of water production
- Coverage of water supply (percentage of the population covered by central or local water supply)
- Renovation of distribution network

- Renovation of service connections (*the part of the network connecting each house or building - often private property*)
- Renovation of intake, treatment and transmission system.

Table 3-1 Types of water intake and treatment in FEASIBLE

	Urban	**Rural**
Water intake and treatment	▪ Groundwater intake, no treatment ▪ Groundwater intake with normal treatment (chlorination, coagulation, sedimentation and filtration) ▪ Surface water intake with normal treatment (chlorination, coagulation, sedimentation and filtration) ▪ Surface water intake with advanced treatment (normal treatment + ozonation and filtration in a granular activated carbon filter)	▪ Hand pumps, groundwater ▪ Groundwater intake, no treatment ▪ Groundwater intake with normal treatment (filtration)

Wastewater system

The key parameters available to describe the service level and set targets for the wastewater treatment system are:

- Wastewater collection rate (percentage of the population connected to sewer system)
- The share of the wastewater collection system to be rehabilitated (% of total)
- Renovation and upgrading of pumping stations (increasing energy efficiency)
- The share of the population connected to a wastewater treatment plant[3]
- Type of wastewater treatment technology (there are six types, see Table 3-2). FEASIBLE provides three levers:
  - Renovation of existing treatment plants which were originally designed to meet a technology standard
  - Upgrading of existing treatment plants to a higher technology standard
  - Extension of the service level by investment in new treatment plants

[3] Collected sewage may be discharged without treatment. Thus, the share of the population connected to a WWTP may be lower or equal to the share of the population connected to the municipal sewer system.

Table 3-2 Types of wastewater treatment technologies

	Urban	Rural
Wastewater treatment	▪ Mechanical ▪ Chemical (phosphorous removal) ▪ Biological ▪ Nitrification ▪ Denitrification ▪ Nitrogen removal	▪ Septic tanks ▪ Reed bed ▪ Biological sand filters ▪ Stabilisation ponds

3.3.2 Municipal Solid Waste Management

The expenditure need for the municipal solid waste management sector is calculated in several stages corresponding to a generalised waste flow as illustrated in the figure below.

Figure 3-4 Generalised waste flow

MSW generation

MSW generation

The first step in the waste flow is waste generation. The waste generation and waste composition figures (per source and fraction) in the base year are entered by the user. FEASIBLE then projects the waste generation per source and fraction in the planning period. The basis for these projections is described in **Appendix 4**.

MSW collection and treatment/recovery

The expenditure need is calculated based on choices regarding technical development measures related to collection and treatment/recovery of the generated waste (the ensuing steps in the waste flow). These technical development measures are listed below. For each, a generic expenditure function forms the basis for the calculation of expenditure need. The expenditure functions are documented in **Appendix 4**.

MSW collection

The key parameters available to describe the service level and set targets for the collection municipal solid waste are:

1 Coverage of collection system (% of population)

2 Type of collection system implemented (various systems options exist for each source, see Table 3-3 below)

Table 3-3 MSW collection systems in FEASIBLE

Source	Collection Systems
Urban, single-family households	1. Ordinary 2. Ordinary + recycling stations 3. Ordinary + recycling stations + bring banks 4. Ordinary + recycling stations + bring banks + kerb-side recyclables collection 5. Dual + recycling station 6. Dual + recycling station + bring banks 7. Dual + recycling stations + bring banks + kerb-side recyclables collection
Urban, multi-family households	1. Ordinary 2. Ordinary + recycling stations 3. Ordinary + recycling stations + bring banks 4. Dual + recycling station 5. Dual + recycling station + bring banks
Rural households	1. Ordinary 2. Ordinary + recycling stations
Commerce and institutions	1. Container ordinary 2. Container ordinary + container recyclables
Industry	1. Container ordinary 2. Container ordinary + container recyclables
Construction and demolition	1. Container ordinary 2. Container ordinary + container recyclables
Wastewater treatment plant	1. Sludge transport

Note: Please refer to **Appendix 4** *for further details*

MSW treatment/recovery

For MSW treatment/recovery, FEASIBLE offers different types of treatment or recovery facilities. The user is required to distribute collected waste to these facilities and to specify existing facilities (incl. those planned to be closed, if any) and new facilities to be constructed. Table 3-4 below provides an overview of the facilities.

Table 3-4 MSW treatment and recovery facilities in FEASIBLE

No.	Recovery/Disposal Facility	Sub-type
1	MRF - Mixed waste	a. Dry mixed waste b. Wet mixed waste
2	MRF - Recyclables	a. Mixed recyclables b. Source separated recyclables
3	MRF - WEEE	Only one type
4	Composting plant	a. Windrow (garden waste) b. In-vessel composting (food waste)
5	Biogasification plant	Only one type
6	Landfill	a. EU b. Controlled landfill c. Dump
7	Incineration plant	a. New - heat/electricity b. New - heat c. Old
8	HHW treatment facility	Only one type
9	C&D recycling facility	Only one type

Note: HHWTF -

3.3.3 Expenditure Needs Results

FEASIBLE provides results on expenditure needs in the planning period in form of year-by-year cash-flow requirements. The results are calculated in international prices by the model. If the user has specified price correction factors, the results are restated in local prices (see section 0).

Results are provided individually for the following types of expenditure:

O&M: The expenditure that is required for the infrastructure to be operational for its planned economic life

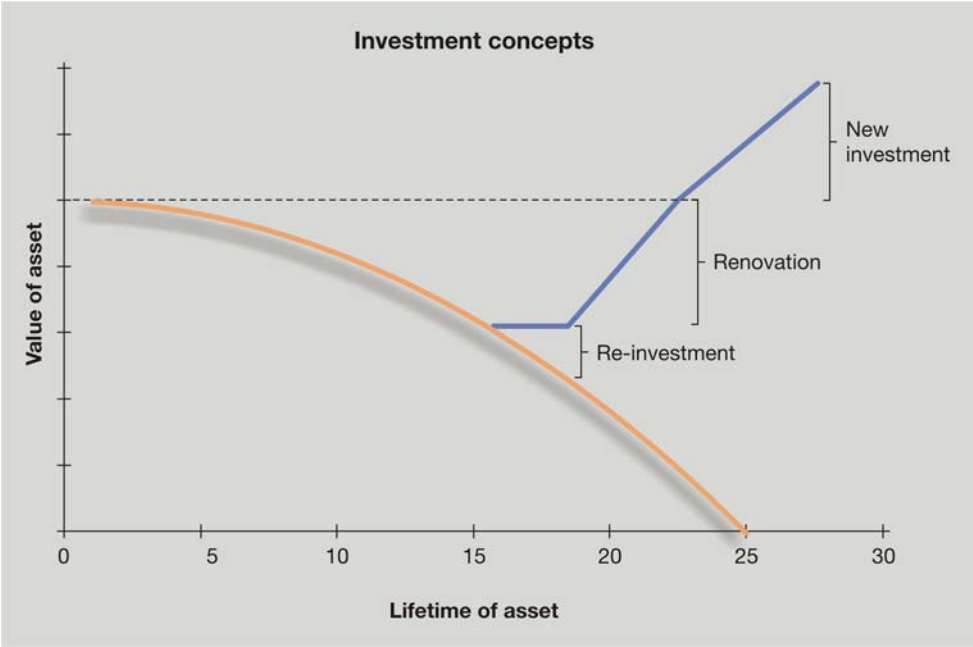
Re-investment: The investment which is necessary to maintain the value of the infrastructure at the present level

Renovation: An investment which increases the value of the infrastructure towards the level originally designed

Improved service level: An investment which increases the service level provided by the infrastructure beyond the level originally intended

The distinction between the various types of investment expenditure is illustrated in the figure below.

Figure 3-5 Types of investment expenditure



3.4 Supply of Finance

In this component, the user is required to specify data on the existing financing situation as well as the future supply of finance. The forecast of the future supply of finance is done by the user as a pre-model exercise. The supply of finance is specified on a year-by-year cash-flow basis.

3.4.1 Sources of Finance

FEASIBLE distinguishes between the following sources of finance:

- User charges
  - from households
  - from industry
  - from other consumers
- Public budget
- Grants
- Loans (other types of debt financing such as bonds and equity could also be modelled here).

  FEASIBLE has a facility where the user can enter lending terms (interest rate, grace period, etc.), and the resulting cash flow is calculated automatically.
- Other

3.5 Financing Gap/Results

The gap assessment component provides aggregated results on the financing gap, expenditure needs, supply of finance and selected technical parameters.

Financing gaps

FEASIBLE compares the cash-flow requirement resulting from the expenditure needs component with the supply of finance on a year-by-year basis. The user may chose to see the gap for specific expenditure types and sources of supply of finance. Box 3-1 contains some examples of types of financing gaps, which may be analysed.

Box 3-1 Examples of types of financing gaps

Total financing gap

- Comparing the total expenditure need with the total supply of financing.

Cost recovery gaps

- Comparing the O&M expenditure need with the supply of finance from user charges
- Comparing the O&M and re-investment expenditure need with the supply of finance from user charges

Re-investment gap

- Comparing the O&M and re-investment expenditure need with the total supply of finance. The accumulated re-investment gap is an indicator of the value of the infrastructure. If an accumulated gap (backlog) appears, the implication is that the infrastructure will deteriorate compared to the base year.

Investment expenditure gap

- Comparing the expenditure need for renovation and upgrading of service level with the supply of finance targeted at capital expenditure*.

Note*: FEASIBLE distinguishes between finance targeted at O&M expenditure (recurrent expenditure) and at investment expenditure (capital expenditure). User charges are assumed to be targeted at recurrent expenditure. Loans are assumed to be targeted at capital expenditure. For the sources of public budget, grants and other, the user has to specify whether the supply is targeted at current expenditure, capital expenditure or both.

4 User Manual - General Issues

4.1 System Requirements

FEASIBLE is a stand alone software to be used on individual PCs.

The minimum requirements in order to install and run FEASIBLE are as follows:

- Pentium processor or similar, speed minimum 200 MHz
- Minimum 64 MB RAM (128 or more recommended)
- Appox. 20-40 MB free disk space (depending on the size of the data set(s) to be used).
- Screen solution of 1024 x 768.
- Operating system Microsoft Windows 95/98/ME/2000/XP. It is recommended that updates or service pack versions be 2002 versions or newer. There is no requirement for a specific update version, but the model has only been tested on systems with 2002 updates.
- If the Russian language version is to be used on an English version of Windows, the relevant fonts and non-unicode facilities must be installed. See the documentation on the operating system for further details.

4.2 Installation procedure

Insert the CD in the CD-drive. In most cases the program will start automatically. If it does not start, open the file manager and go the CD folder. Then open the file "Start FEASIBLE Model". The file uses Windows Internet Explorer. It offers the choice of either installing the FEASIBLE Model or viewing the user manual.

In rare cases, for example if the computer uses a dial-up connection, some error messages may occur. In that case, accept the messages, answer *No* or *Cancel* when asked whether you want to connect, after which the start-up page will fi-

nally appear. In case the Windows Internet Explorer is not available, the program may be installed by activating FEASIBLE setup.exe.

On the start up page, press the *Install the FEASIBLE Model* button in order to start the installation of the model. During the installation of FEASIBLE, you will be prompted a number of times.

- When selecting "Install the FEASIBLE Model", you will be asked whether you want to *Open* (or Run) the program from its current location or *Save* to disk. Select *Open* (or *Run*).

- Then, answer *Yes* to view the installation instructions.

- Answer *Yes* to have a shortcut placed on your desktop or easy access to the program. You may modify the location of the program files, if you wish.

- You may answer *Yes* to create a backup.

It is a pre-condition for installation of FEASIBLE that the screen resolution is 1024x768. If it is less, the program will not be installed. The program should be able to run on a Windows 95 platform and later versions. The installed program may be removed by using the UNWISE.EXE.

4.3 Overview - General Component

When opening FEASIBLE, the following screen will appear.

The buttons at the bottom of the screen are used to open the different components of the model.

The buttons at the left side of the screen are used to access different elements within each component in the given sequence. Each button opens a new screen or set of screens. Each screen and sub-screen of the general component and the input required are explained in sections 4.4 to 4.11 below. Similarly, sections 5 - 9 explain the screens, sub-screens and input required for *Solid waste, Water supply, Wastewater, Supply of Finance* and *Results.*

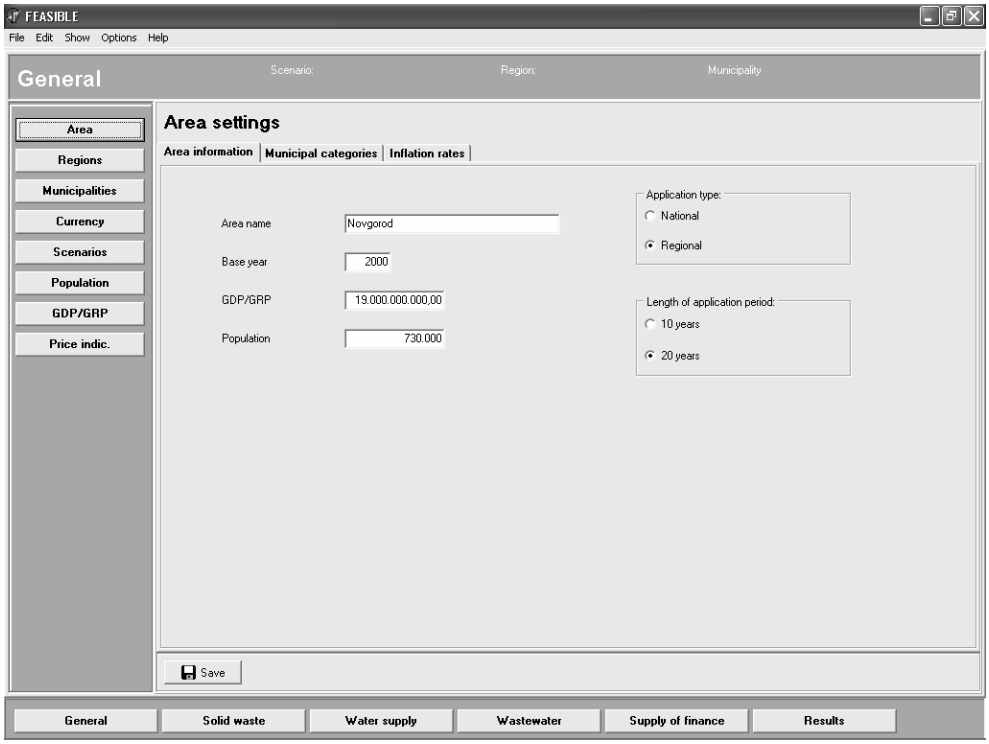
4.4 Area

Area settings includes 3 sub-screens in which a number of general specifications should be entered: *Area information, Municipal categories,* and *Inflation rates*.

Area information

The following information is needed in the first sub-screen, *Area information*:

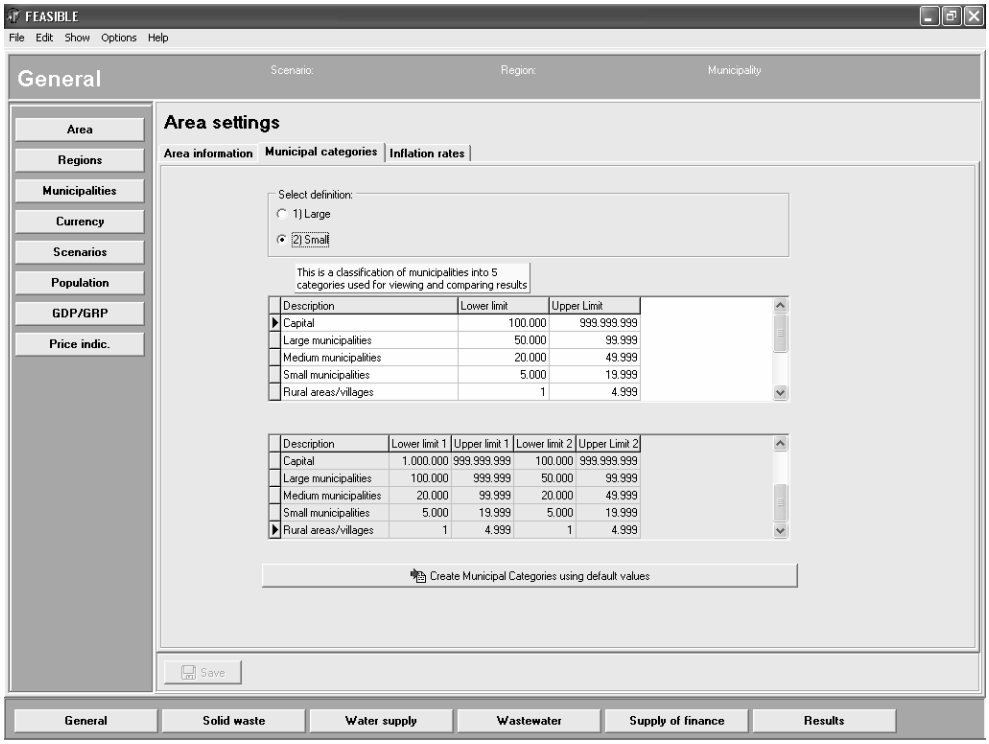
- *Area name* (for user information, only, not used as such in the model)
- *base year* is the year for which the input data is based on actual recorded or estimated values. Thus, the base year should not be a year in the future. Typically, it will be the previous or current year according to data availability.
- *GDP/GRP* is the gross domestic/regional project in local currency (the currency is specified later), but the values is supposed to in national currency.
- *population* is the total population in the area.
- *application type* is either an whole country or a region within a country. (This is used mainly for information).
- *length of application period* is either 10 or 20 years.



Municipal categories

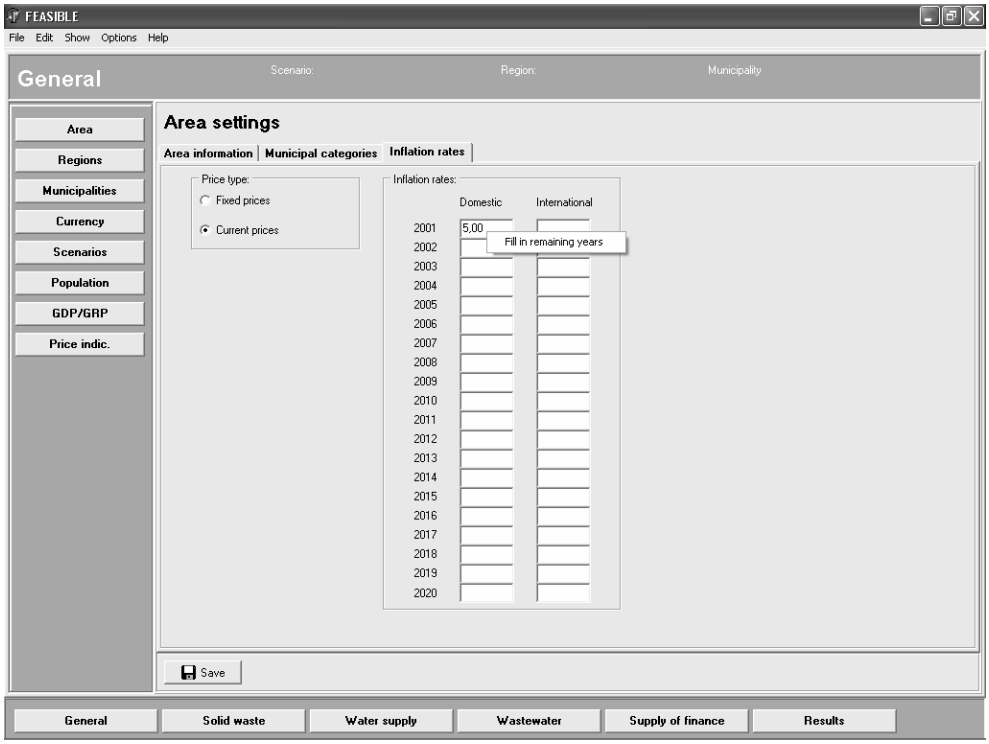
In the second sub-screen, *Municipal categories*, it is possible to define five categories of municipalities The five categories are used to group individual municipalities according to number of inhabitants. The categories are used when comparing the expenditure and finance results.

The user may choose one of the two default settings, or enter a different definition by filling in data in the white fields. The upper limit of the category with the largest municipalities should not be changed and neither should the lower limit of the category with the smallest municipalities. The names of the categories may also be changed.



Inflation rates

In the last sub-screen, *Inflation rates*, specify the definition of the type of price level to be used. The choice is between fixed and current prices.

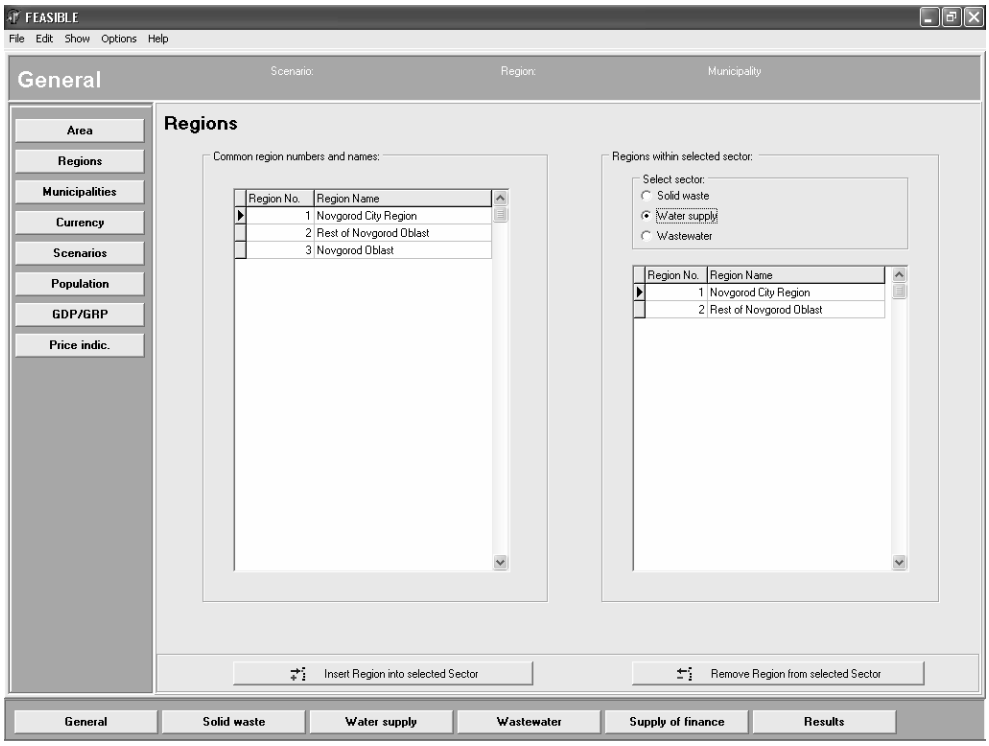


In case of *Fixed prices*, the year of the price level may be specified. It is not actively used in the calculations, but displayed in relation to results tables etc. The use of *Current prices*, input on domestic and international inflation rates is required. The domestic inflation could be the projected increase in producer

prices. International inflation could be average EU inflation rates or changes in producer prices.

4.5 Regions

On the *Regions* screen, the gross list of regions is defined, and the regions are assigned to the sectors.



The table on the left side, is used to define the gross list of all the regions that are going to be used. The table on the right side, is used to assign regions to each sector. Start by selecting a sector, and then double click on a region from the gross list thereby transferring that region to the sector list.

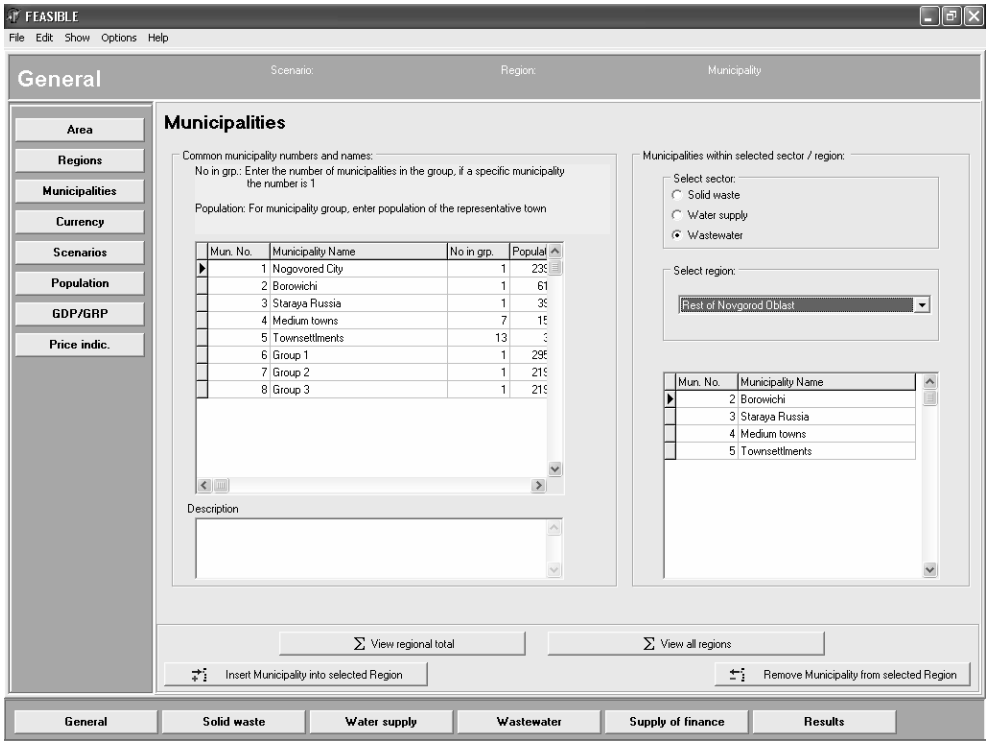
4.6 Municipalities

On the *Municipalities* screen, individual municipalities and groups of municipalities are defined and assigned to regions within each sector.

In the table on the left, define all municipalities to be used by an *ID number*, *name*, *number of municipalities* and *population*.

Number of municipalities is relevant in cases where a group of municipalities is defined. If the entry concerns one specific municipality, the number should be 1. If it is a group, e.g. municipalities with 10-20 thousand inhabitants, the population size should be the average number of inhabitants of these municipalities, i.e. in this example, a figure between 10 and 20 thousand.

If a different special or geographical structure is used across sectors, the municipalities may overlap. The total number of municipalities in the gross list may thus exceed the total number of municipalities in the area.

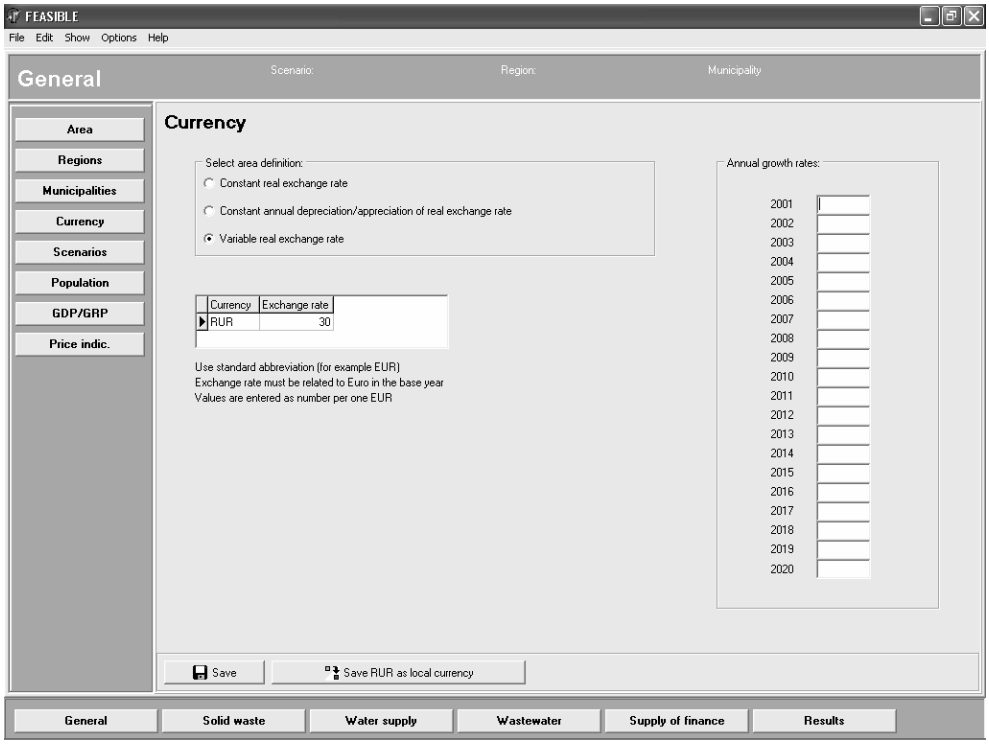


On the right side of the screen, the municipalities are assigned to each sector either by using the *insert municipality in selected region* button at the bottom of the screen or by double clicking the name of the municipality in the gross list.

The two buttons ∑ *View total* concerning one or all region(s) respectively, makes it easy to check whether the population data is correct and the right number of municipalities has been assigned to each sector.

4.7 Currency

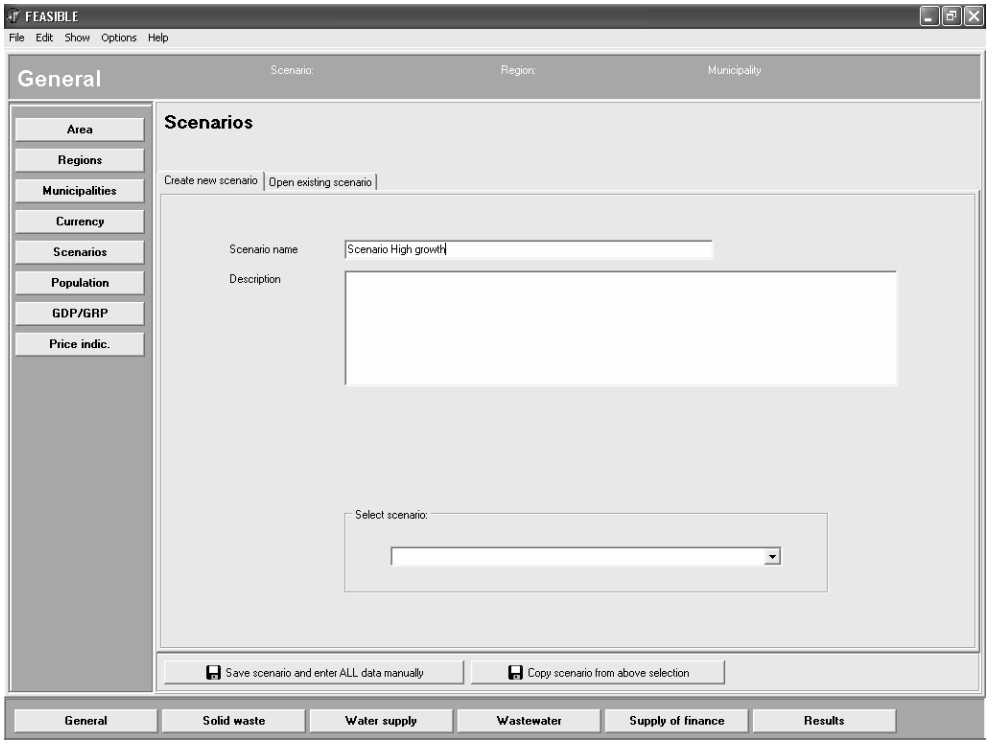
In the *Currency* screen, the name of the national currency is entered together with exchange rate in relation to EUR. It is possible to chose a constant rate, a constant changing rate or a variable real exchange rate.



4.8 Scenario

All data entered in the previous screens is general to the current application of the FEASIBLE and cannot be changed as part of the scenario analysis.

The screens presented from this point forward are scenario specific, meaning that all data relates to a given scenario.



The *Scenarios* screen is used to create a new scenario. There are two ways in which to enter data for new scenario:

- One is to manually open all folders and enter the data. This procedure is necessary for the first scenario, which will usually be called the baseline scenario. To choose this option, click *Save scenario and enter ALL data manually.*

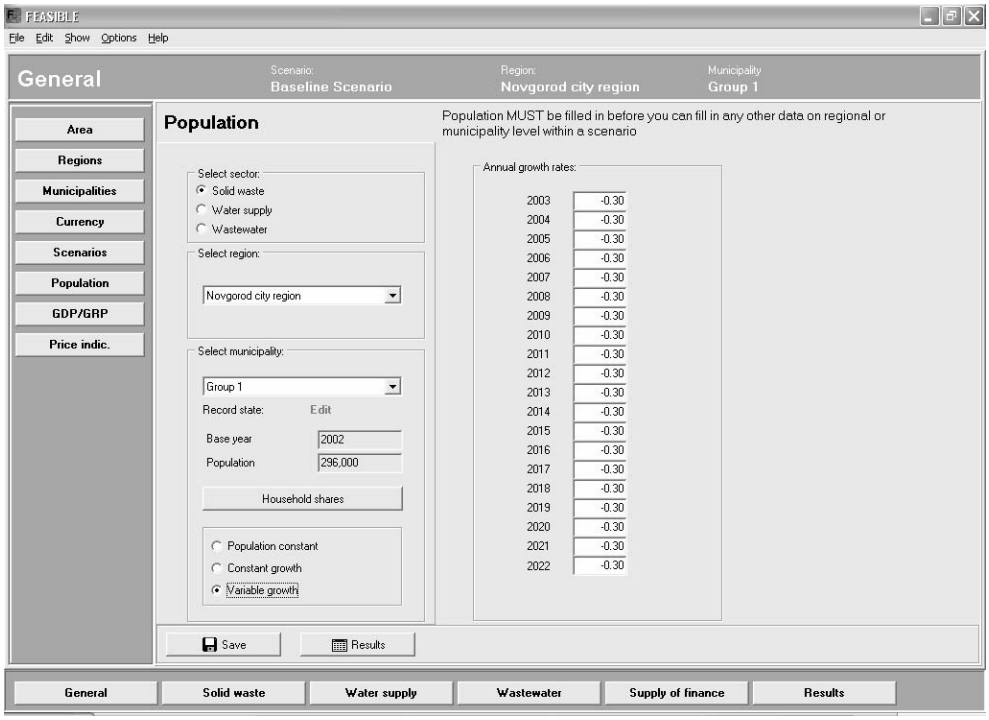
- Having made the first scenario, a new scenario may be created by copying data from an existing scenario. At first, the new scenario will contain the same data as the one on which it based. Then enter the relevant screen(s) and change data to reflect the purpose of the scenario. To choose this option, click *Copy scenario from above selection.*

It is also possible to delete a scenario using the *Delete above scenario selection* button.

4.9 Population

In the *Population* screen, a projection of the population in each municipality within each region is entered. If the same municipality is used for more than one sector, data has to be entered twice.

It is very important the population data be entered for all relevant combinations of sector, region and municipality. Only if population data has been entered, will FEASIBLE be able to recognise the combination and the specific sector data can be entered.



For the solid waste sector, there is a sub-screen called *Household shares*. This sub-screen is used to indicate the distribution of the population data on three types of households reflecting the type of housing, viz.:

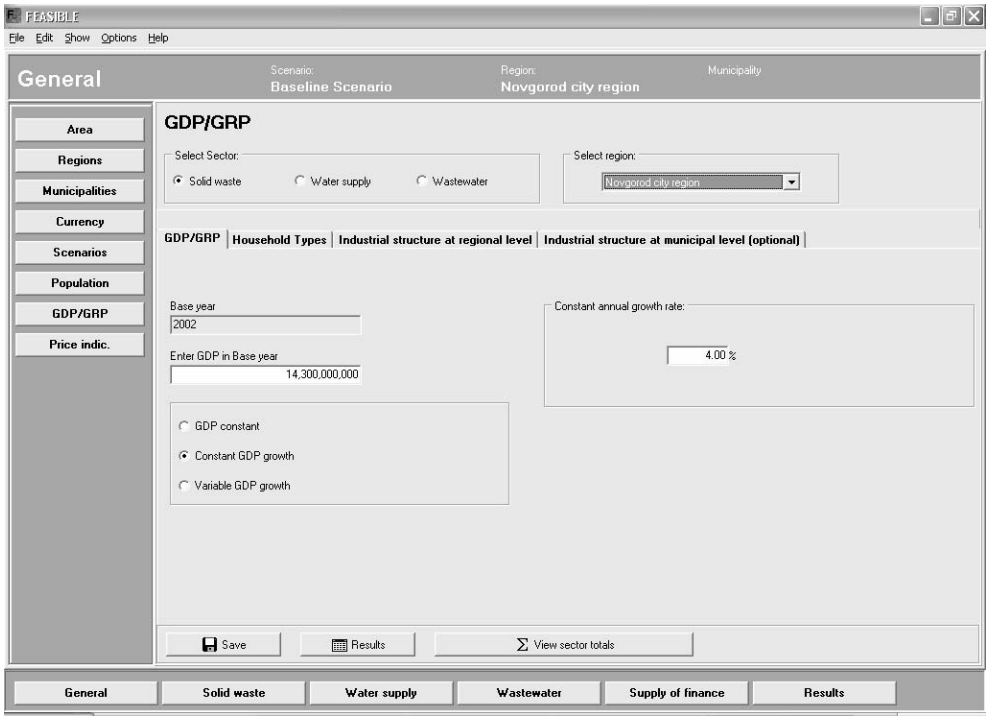
- urban single-family (USF) households ;
- urban multi-storey (UMS) households
- rural households.

The shares have to add up to 100%, and therefore, the share of rural households is calculated as the residual by the model when the *Save* button is used.

The button *Results* will open sub-screen which summarises all inputed population data.

4.10 GDP/GRP

The *GDP/GRP* screen is used to enter gross domestic product or gross regional product values.



For the solid waste sector, there are three sub-screens which are used to define the GDP/GRP values in terms of:

- *Types of households*, see under section 4.9 Population
- *Industrial structure at regional level*.
- *Industrial structure at municipal level*, which is optional. If no values are entered, the industrial structure given at the regional level will apply to each municipality within the region.

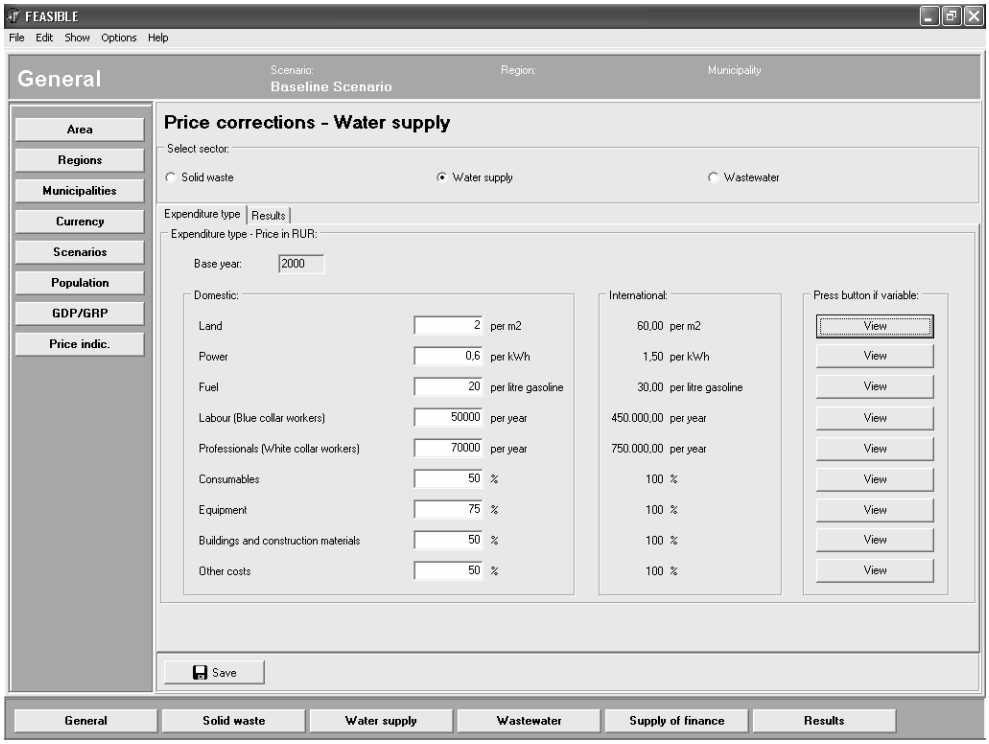
The button *Results* will open sub-screen which summarises all inputed GDP/GRP data.

4.11 Price Indicators

In *Price indicators* there are two sub-screens: *Expenditure type* and *Results*.

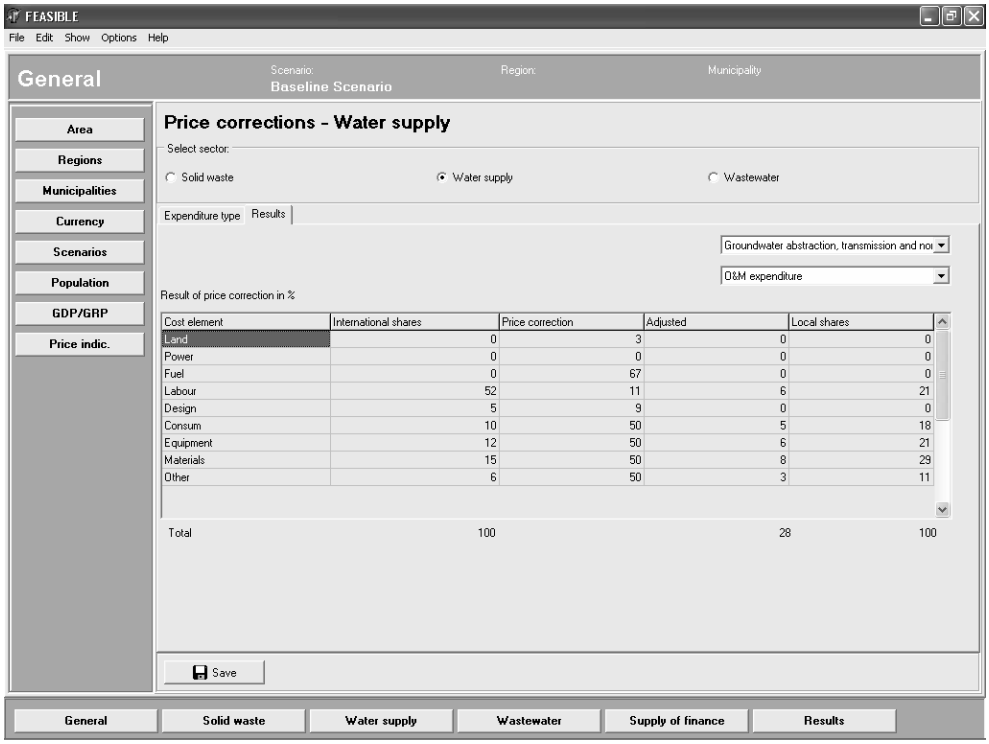
Expenditure type

Enter values in national currency or in %. The projections are always made by growth rates in %.



Results

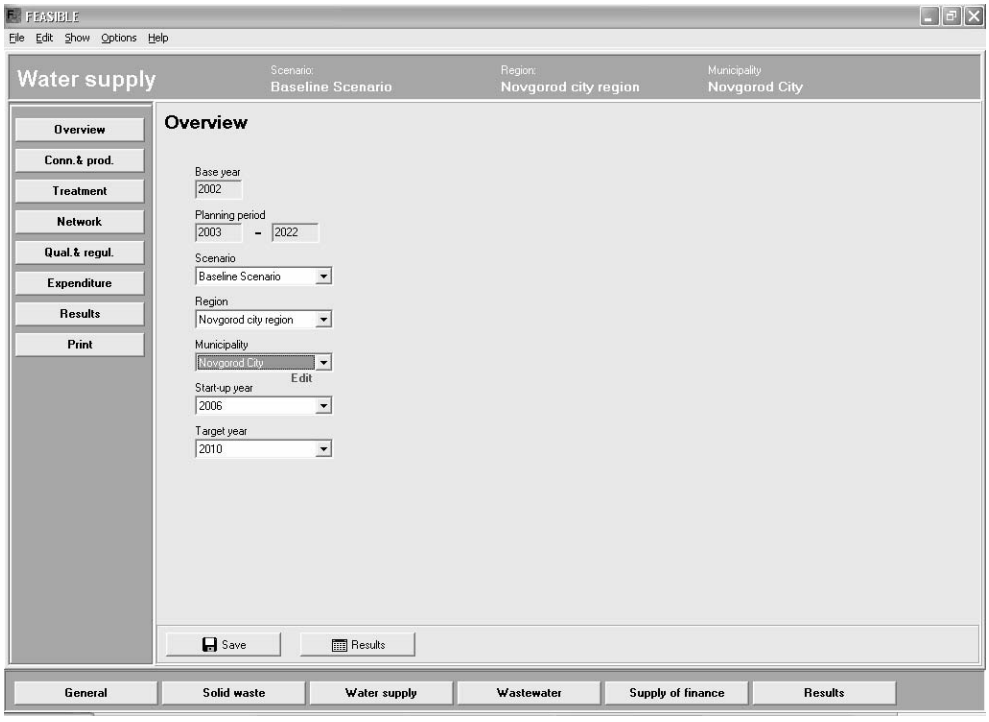
No data is to be entered in the *Results* sub-screen. It is used to show the results of the values entered in *Expenditure type* sub-screen.. The table shows the effect of the price indictors on the replacement values and O&M costs of a selection of different technologies within each sector.



5 User Manual - Water Supply Module

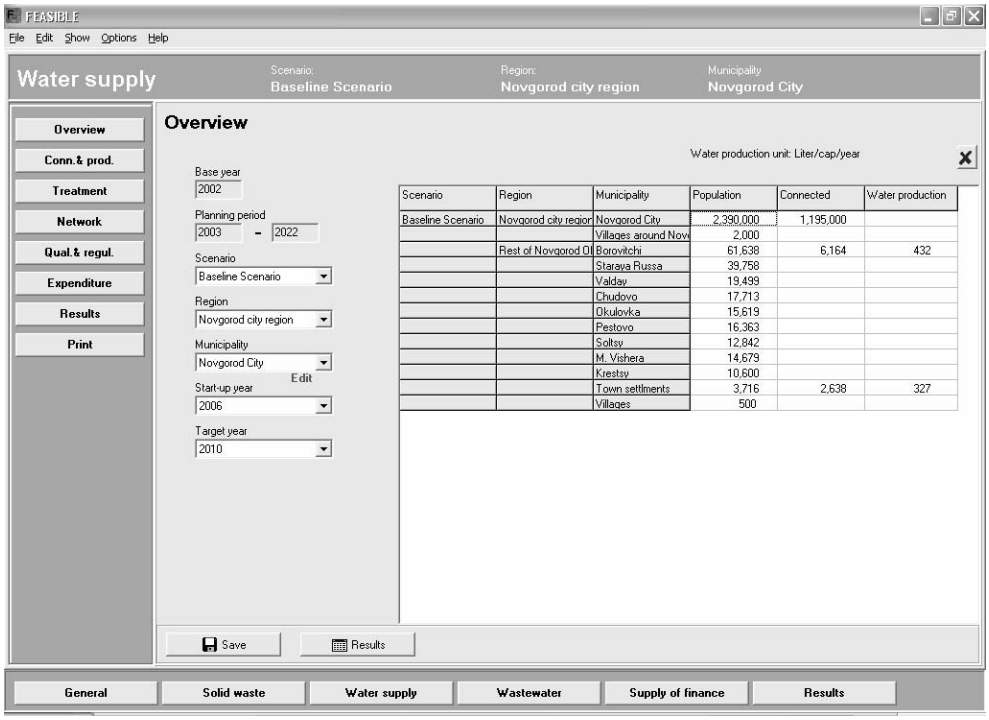
To enter the water supply module, select the *Water Supply* botton at the bottom of the screen.

In the *Overview* screen, specify scenario and municipality for which you want to enter data. For the first scenario, start by selecting one region and fill in data for each municipality or municipality group within that region. Then repeat the procedure for the remaining regions.



Start-up year relates to the target year changes. The *start-up year* is the year in which any of the changes should start to be implemented. For example, if renovation of some infrastructure is to be achieved by the target year, the start-up year indicates the year in which the renovation is initiated.

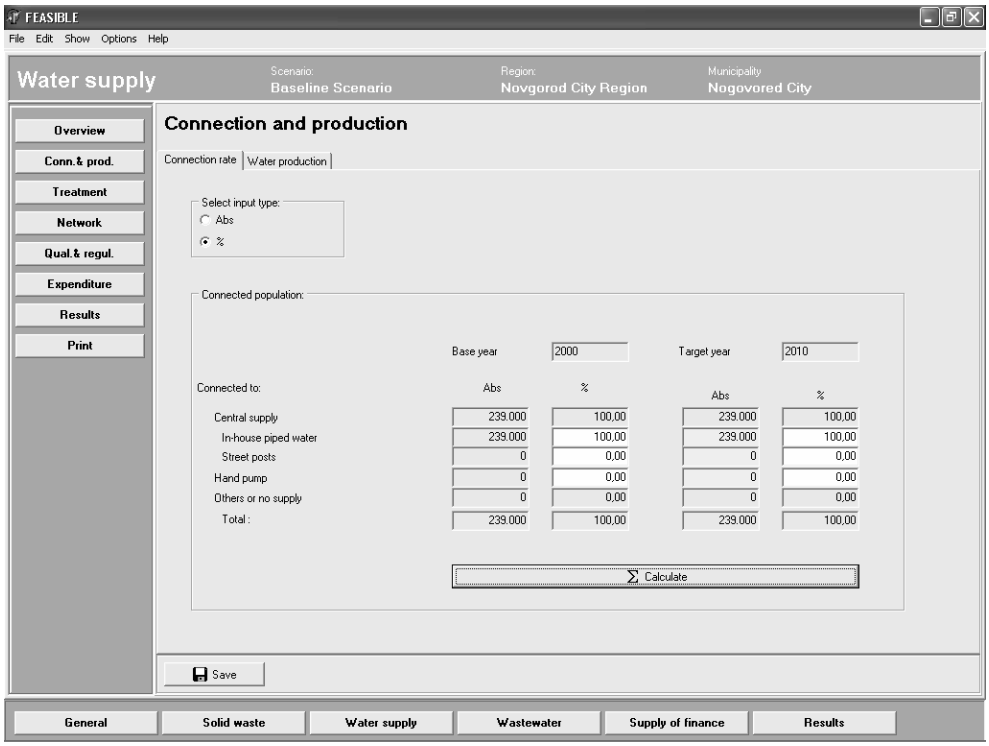
Results button opens new screen with summary of several water supply related data.



5.1 Connection and Production

Connection rate

Data on connection rates may be entered either as the absolute number of persons connected or as a percentage of the inhabitants.



There are four types of connection, in-house piped water, street posts, hand pumps, and no direct supply. The difference between in-house piped water and

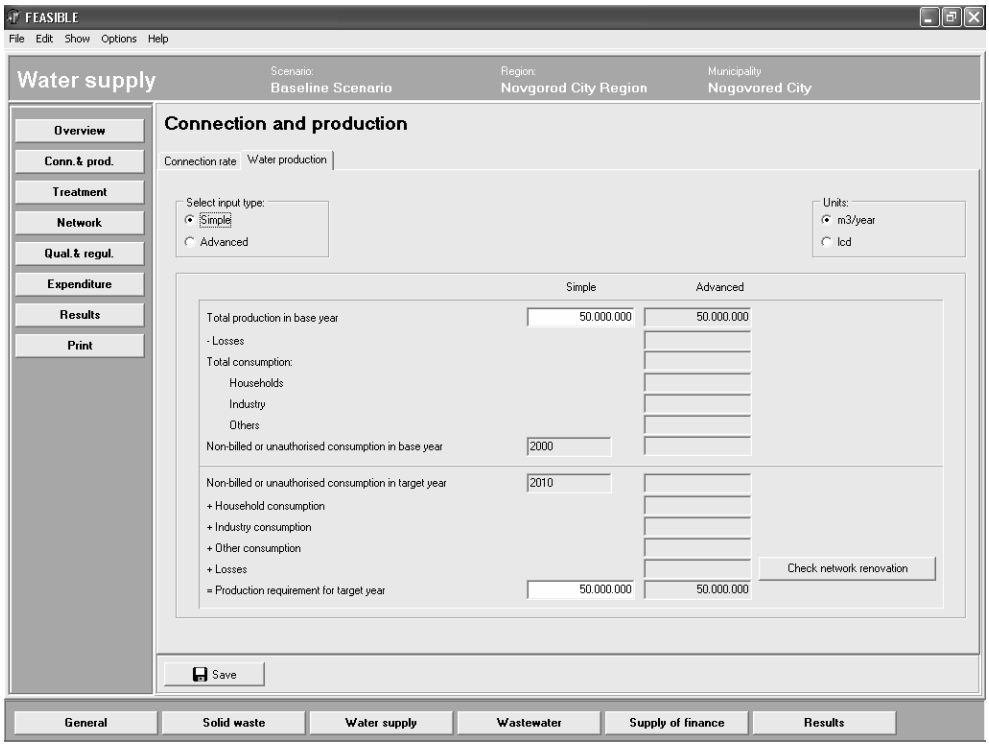
street posts is the service connections. Service connections are the usually privately-owned part of supply system connecting the individual house to the main distribution net. Hand pumps are assumed to be individual solutions serving only one or few houses.

Water production

Data on water production may be entered in a simple or a more advanced format.

- Choose *simple* to simply enter data for the water production in the base year and the target year. The data may be entered as the total annual production in m^3 or as the production in litre per capita per day (lcd = litre/capita/day).

- Chose *advanced* data input to enter consumption and losses for both the base year and the target year. FEASIBLE only uses the total production value, but the structure of the advanced format represents the type of pre-model analysis which the user has to carry out.



5.2 Water Treatment

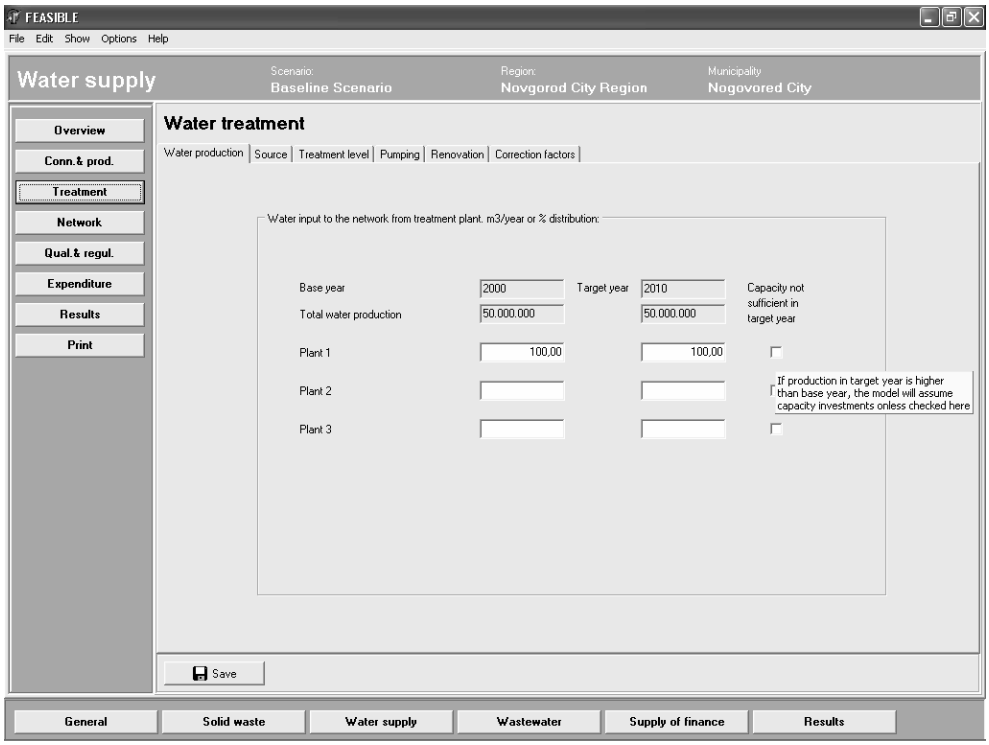
The *water treatment* screen includes five sub-screens:

- Water production
- Source
- Treatment level
- Renovation
- Connection factors

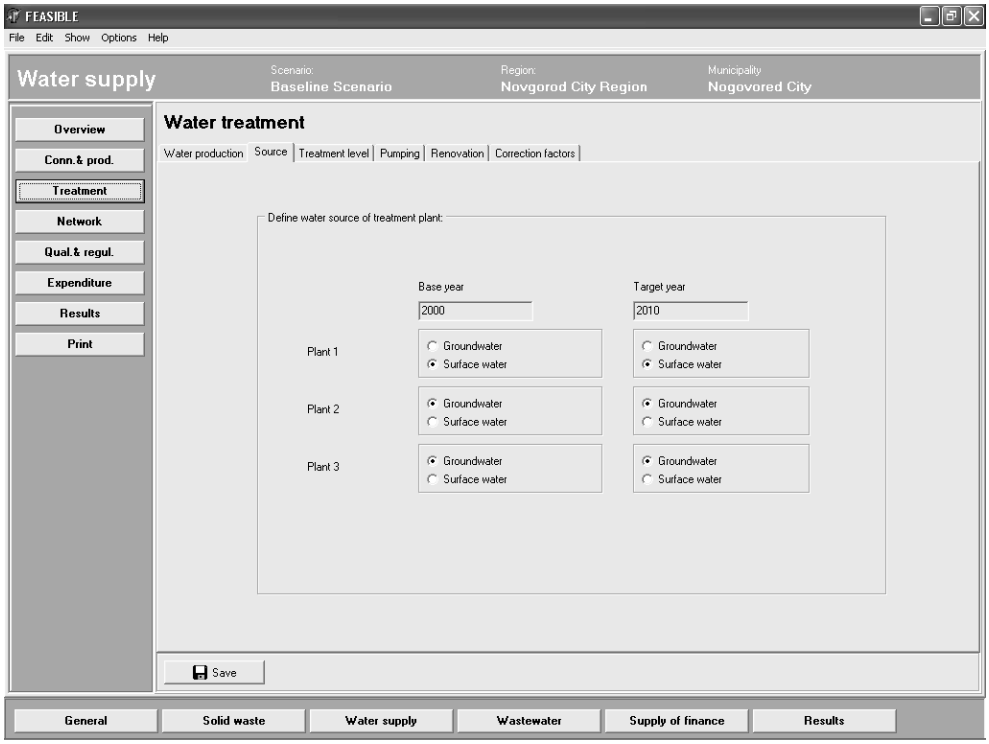
Water production

Water production data may be distributed on three plants. Production data for each of the plants may be given in any format, only it has to be the same format for all plants. FEASIBLE calculates the relative share in total production for each plant.

Use the check box at the right to indicate if the current capacity is not sufficient to supply the necessary amount in the target year. This only relevant in case the water production will increase from the base year to the target year. The O&M costs as well as annual re-investments are estimated by FEASIBLE using the actual production and not the capacity. In many cases, existing plants have excess capacity and, thus, there will be no need to invest in additional capacity, should the production volume increase.

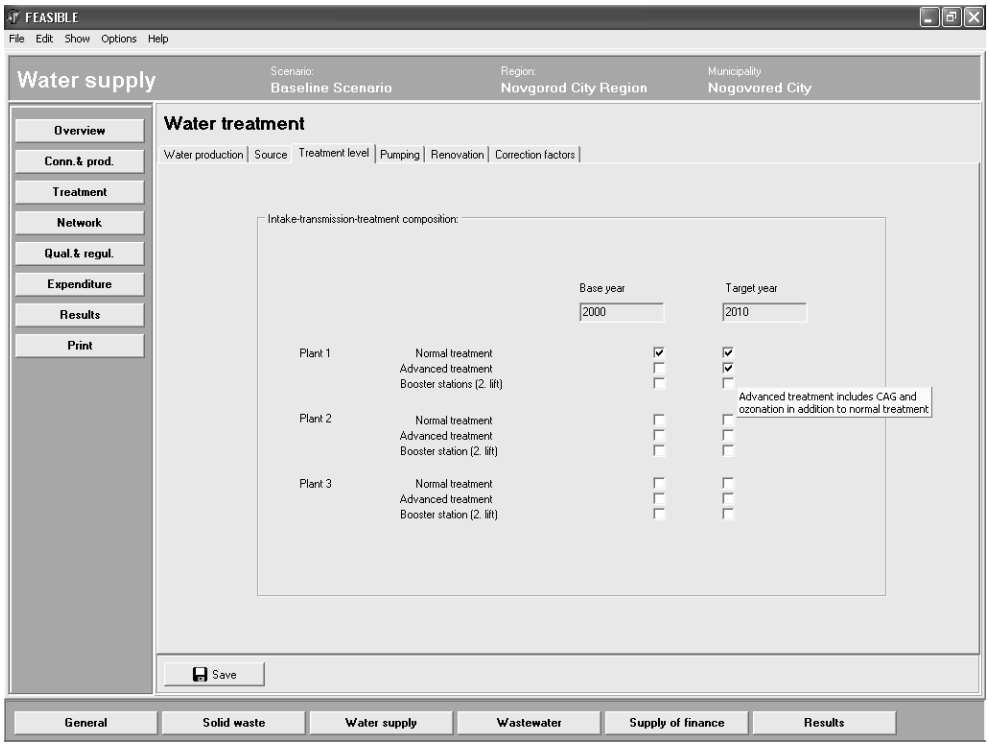


If the existing capacity is not sufficient for the future production, mark the check box and FEASIBLE will estimate an investment in additional capacity.



Source

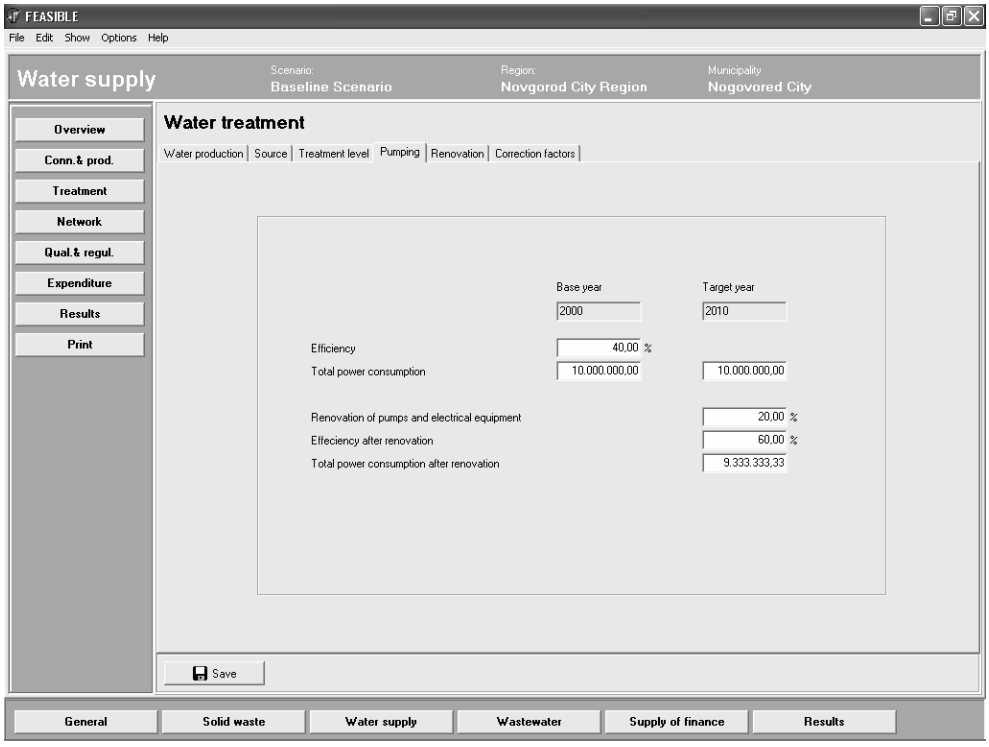
In the second sub-screen, specify the source of raw water for each plant: either groundwater or surface water. For municipalities with less than 5,000 inhabitants, the only option available is groundwater.



Treatment level

In the third sub-screen, fill in the level of treatment of the raw water as well as information on the level of pumping in the form of booster stations. The options are *1st lift and transmission* (i.e. no treatment), *normal treatment* and *ad-*

vanced treatment. For municipalities with less than 5,000 inhabitants, the only options available are no or normal treatment.

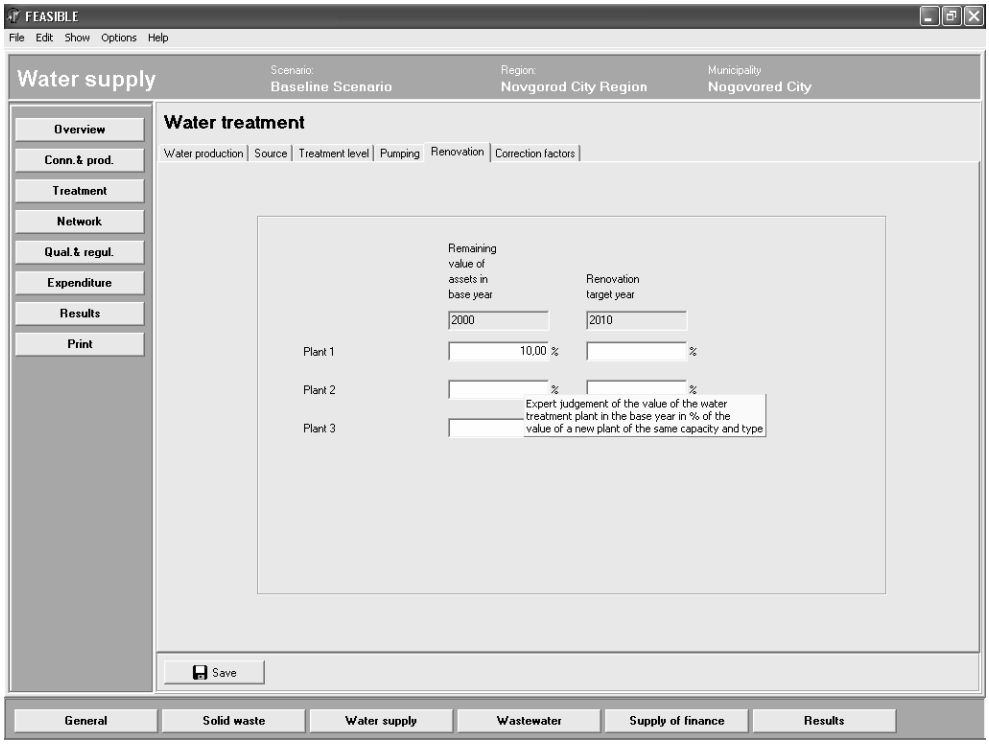


Pumping

On screen the pumping, specify your assumption as to the pumping of water for distribution. FEASIBLE will insert defaults on efficiency and total electricity consumption. You may modify if actual values are known and different form the default values.

Renovation

In the renovation sub-screen, specify your best estimate of the remaining value of the treatment plant in % of the replacement value of a new plant. The value entered will influence the estimated re-investment need; see Appendix 1 for more details)

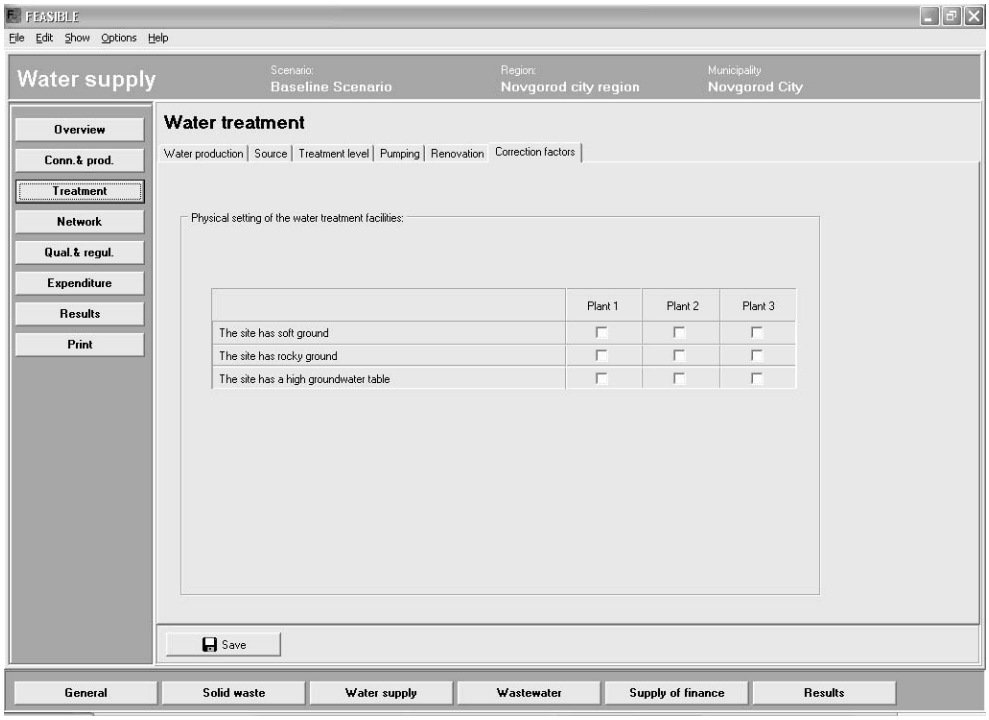


The specification of renovation need is, of course, optional in the sense that a value should only be inserted if a renovation project is assumed to take place.

Correction factors

The last sub-screens, technical correction factors may be indicated.

Technical correction factor	**Value**
The service areas have soft ground, which implies that either the ground must be excavated and filled with sand or the pipes must be piloted	1.2
The service areas have rocky ground, which implies difficult excavation conditions or a need for blasting	1.2
The service areas have a high groundwater table, which implies pumping during the construction period	1.1



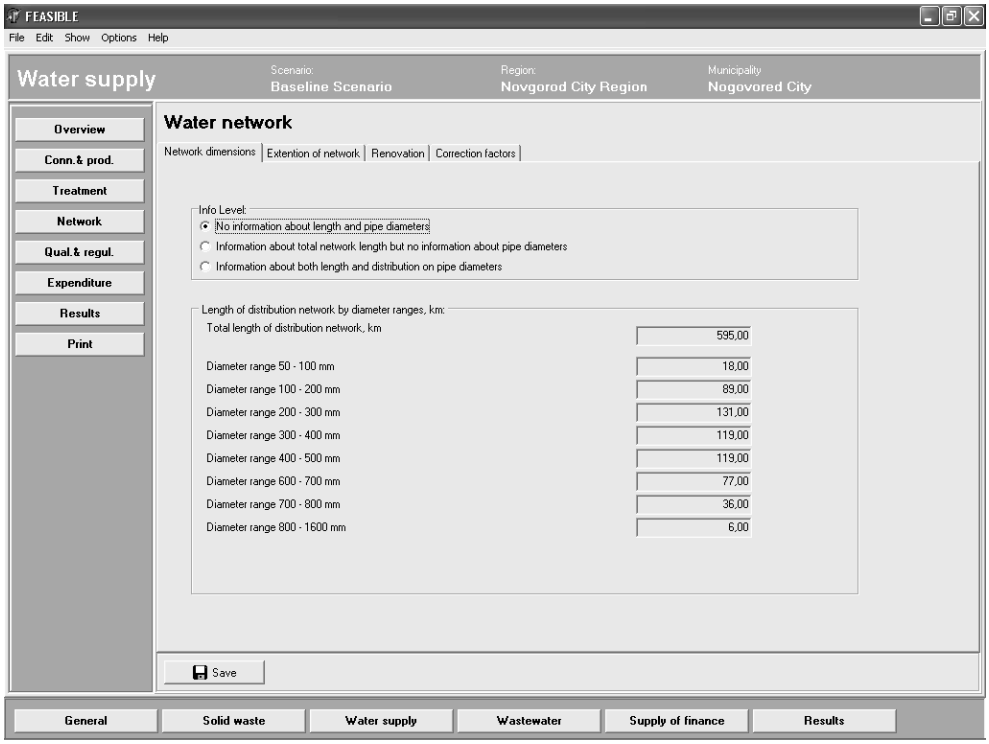
5.3 Network

In *Water network*, there are four sub-screens:

- Network dimensions
- Extension of network
- Renovation
- Correction factors

Network dimensions

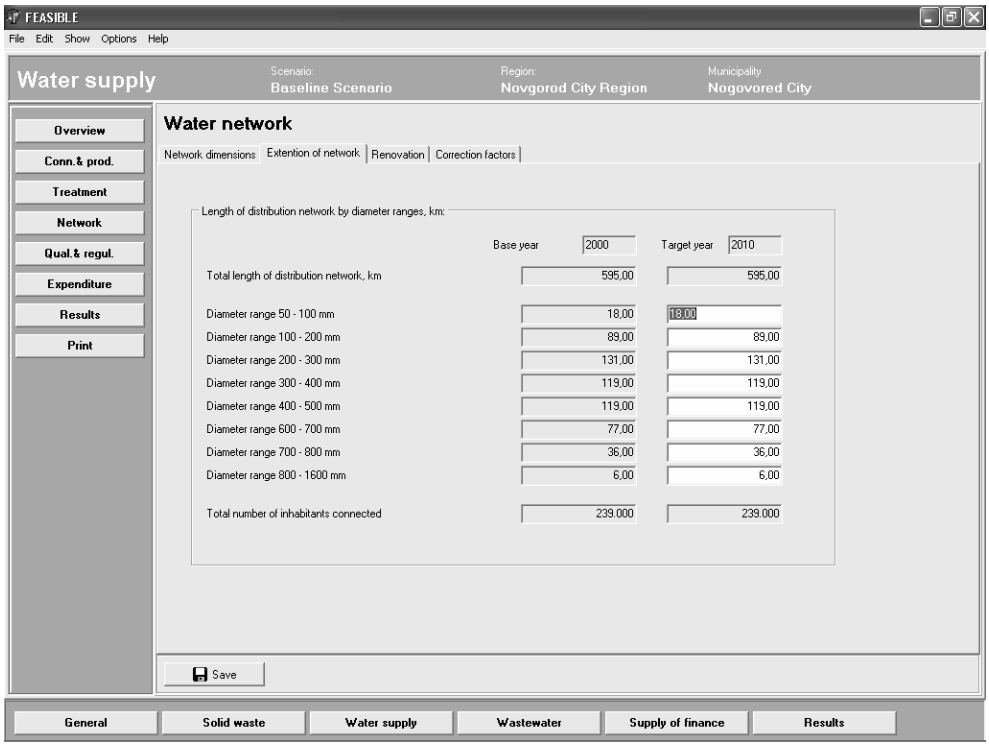
This sub-screen comprises data on the length of the network. Start by selecting info level depending on the amount of information available:



1 No specific information is available about the pipes. FEASIBLE should use default values.

2 The total length of the distribution network is known. FEASIBLE should distribute the total length on diameter groups based on default values.

3 Data on the length of different pipe diameters is available.



Extension of network

The *Extension of network* sub-screen comprises data on the network in the target year. FEASIBLE presents an estimate of the length of the network within each diameter group. This estimate is based on the changes in number of inhabitants connected to the system. A 10% increase in the number of connected inhabitants will also increase the network length by 10%. Other values may be entered by simply overwriting the model estimates.

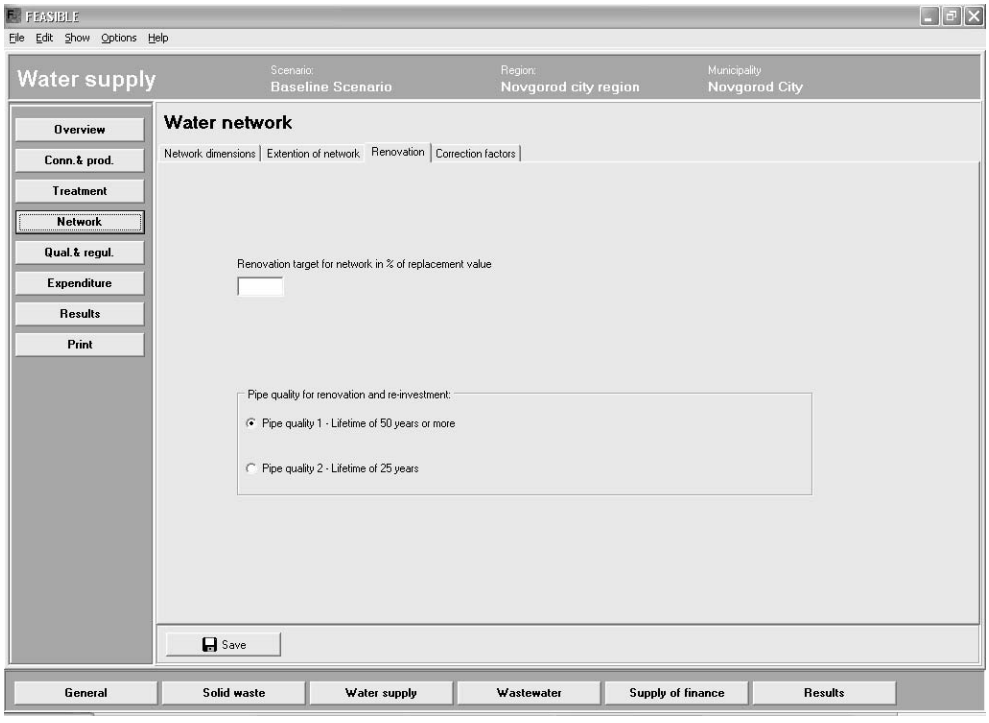
Renovation

The *Renovation* sub-screen provides the option to specify a renovation project for the main distribution network and/or for the service connection. Enter the percentage of the network to be renovated.

There is also an option to choose between two types of pipe qualities. The implication is that the annual need for re-investment and replacement will be 2% of the total pipe length for pipe quality 1 and 4% for pipe quality 2.

Pipe quality	Price level of pipes	Lifetime of pipes in years
Pipe quality 1	International price level	50
Pipe quality 2	50% of international price level	25

Source: Consultant's estimate

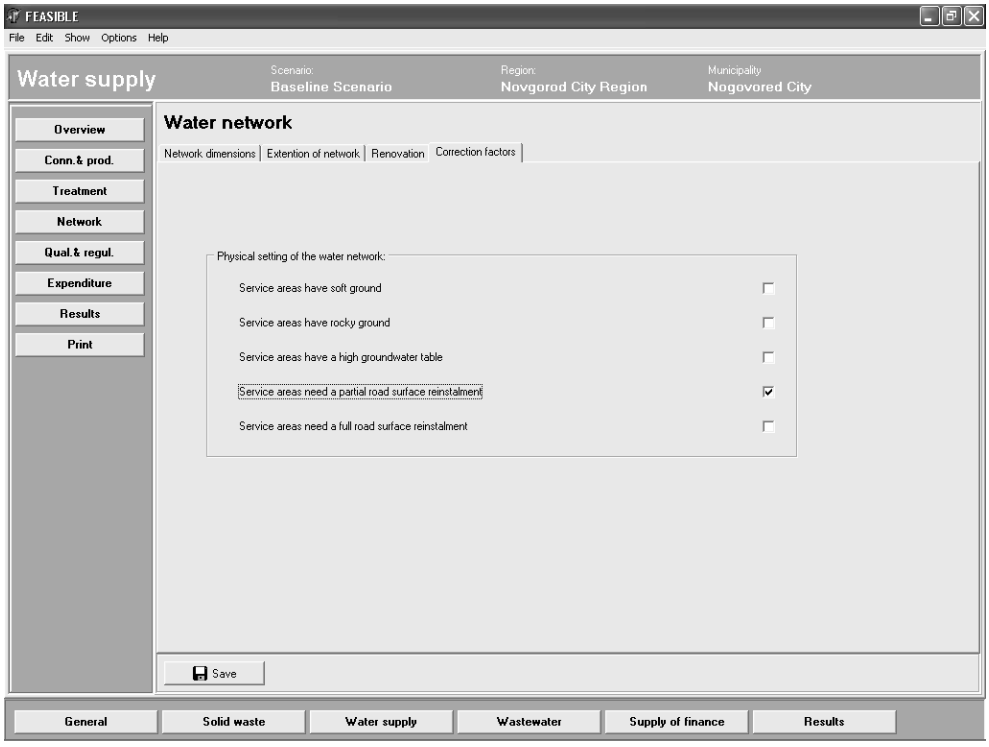


Correction factors

The last sub-screen contains the technical correction factors.

Technical correction factor	Value
The service areas have soft ground, which implies that either the ground must be excavated and filled with sand or the pipes must be piloted	1.2
Service areas have rocky ground, which implies difficult excavation conditions or a need for blasting	1.2

Technical correction factor	Value
The service areas have a high groundwater table, which implies pumping during the construction period	1.1
The services area need only partial surface (road) reinstatement	0.8

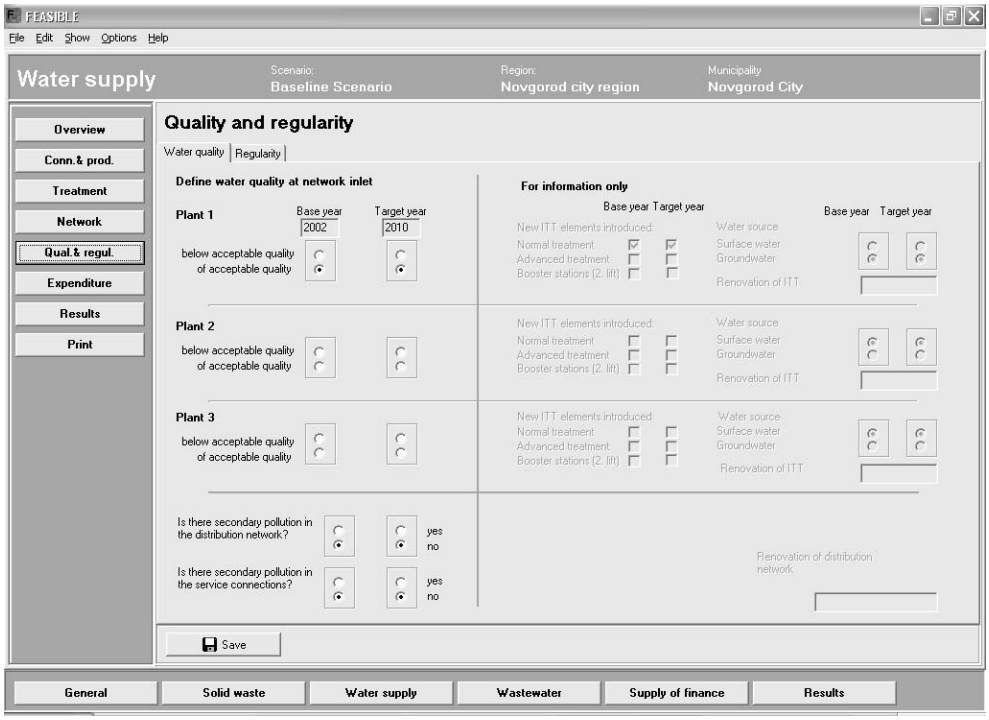


5.4 Quality and Regularity

The two sub-screens, *Water quality* and *regularity*, represent two important service parameters.

Water quality

The quality of the water at the tap depends on the quality of the raw water, the treatment technology applied and the quality of distribution network including service connection.



There is no automatic link between the choice of raw water source, treatment and renovation of pipes. The user has to determine whether the quality of the supply water complies with national health standards. Specify the level of compliance in the base year and the target year. For the target year, changes in source, treatment technology and renovation of pipes are indicated to help in determined whether these measures are sufficient in order to achieve compliance with water quality standards.

Regularity

Regularity is question of whether the water is supplied on a 24-hour basis or some form of scheduled water supply prevails. Specify whether the existing situation can be described as regular supply or not. In case the current situation is not regular supply, indicate whether the measures applied will be sufficient to achieve regular supply in the target year.

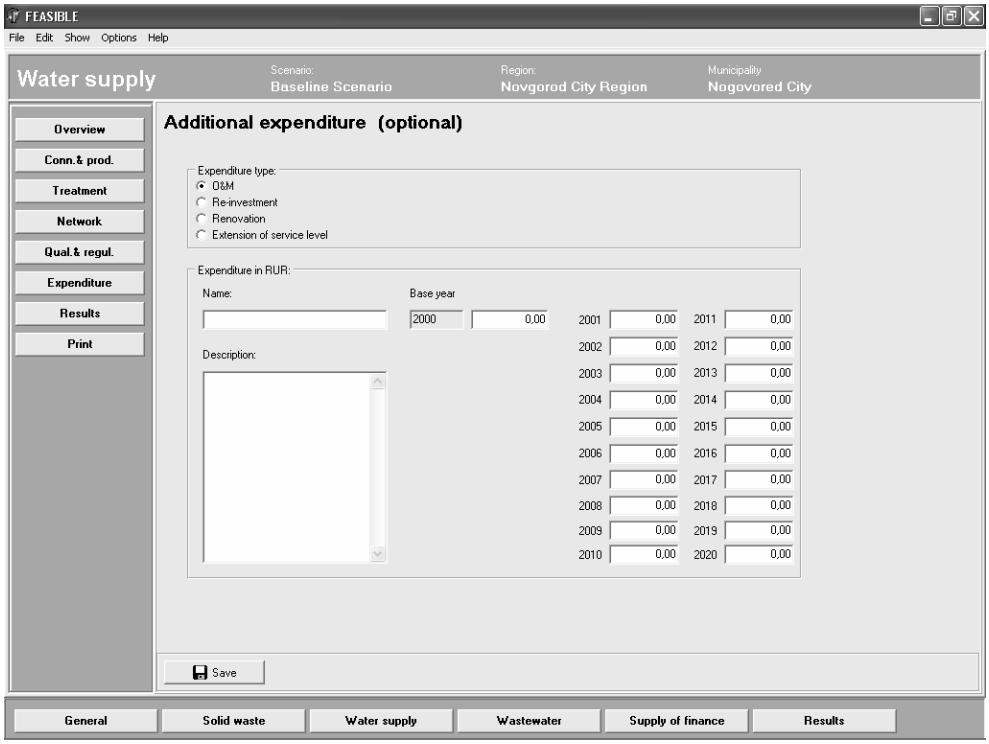
5.5 Additional Expenditure (Optional)

Input in the *Additional expenditure* screen is optional. It may be used in two types of situations:

- to include expenditure resulting from a type of water infrastructure or service not included in FEASIBLE; or
- to correct or modify the cost estimates for a particular municipality.

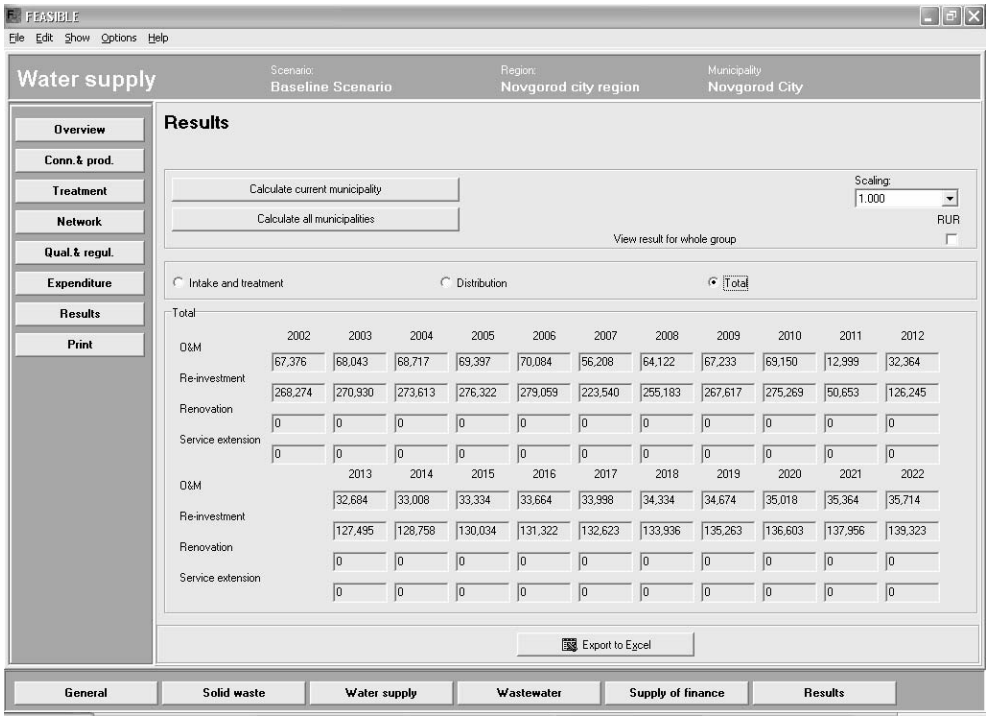
In order to modify the results calculated by FEASIBLE, enter negative or positive values for the type of expenditure in question.

The expenditure should be expressed in the national currency and in fixed or current prices as selected by the user in *General, Area, Inflation rate*.



5.6 Results

The *Results* screen shows the expenditure results for the municipality in question.



The expenditure can be shown for *Intake and treatment*, *Distribution* or *Total*. The costs of hand pumps are included in *Intake and treatment*. Use the check

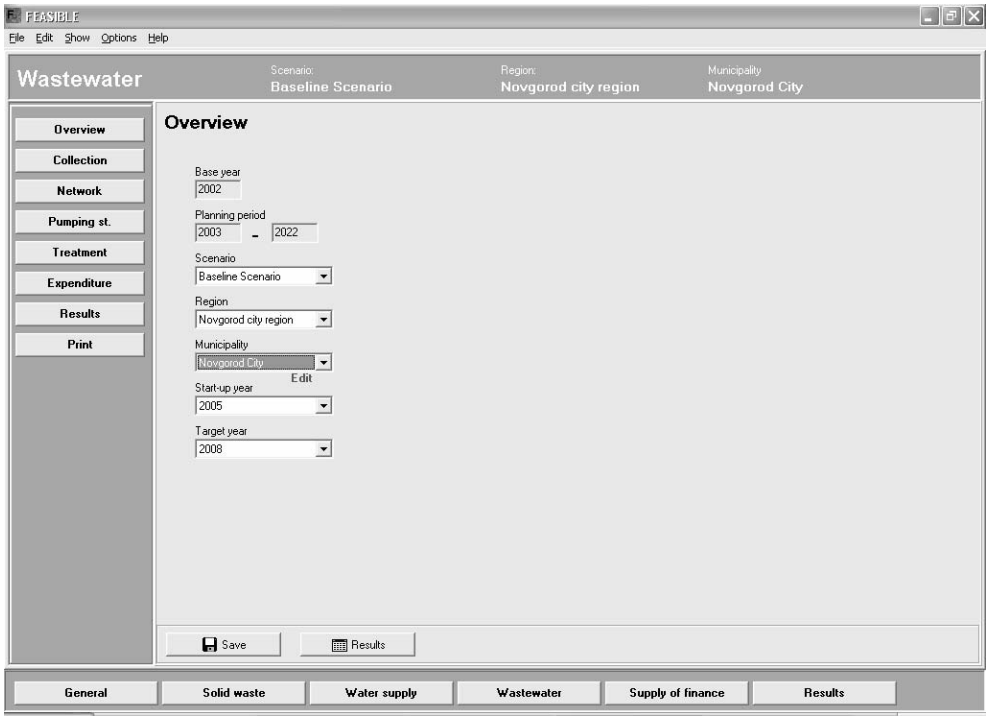
box at the right chose whether to display data for the representative town in a group of municipalities or for the total group.

The function of the button *Calculate all municipalities* is to recalculate results of water supply for all the municipalities when changes in the input data have been done.

6 User Manual - Wastewater Module

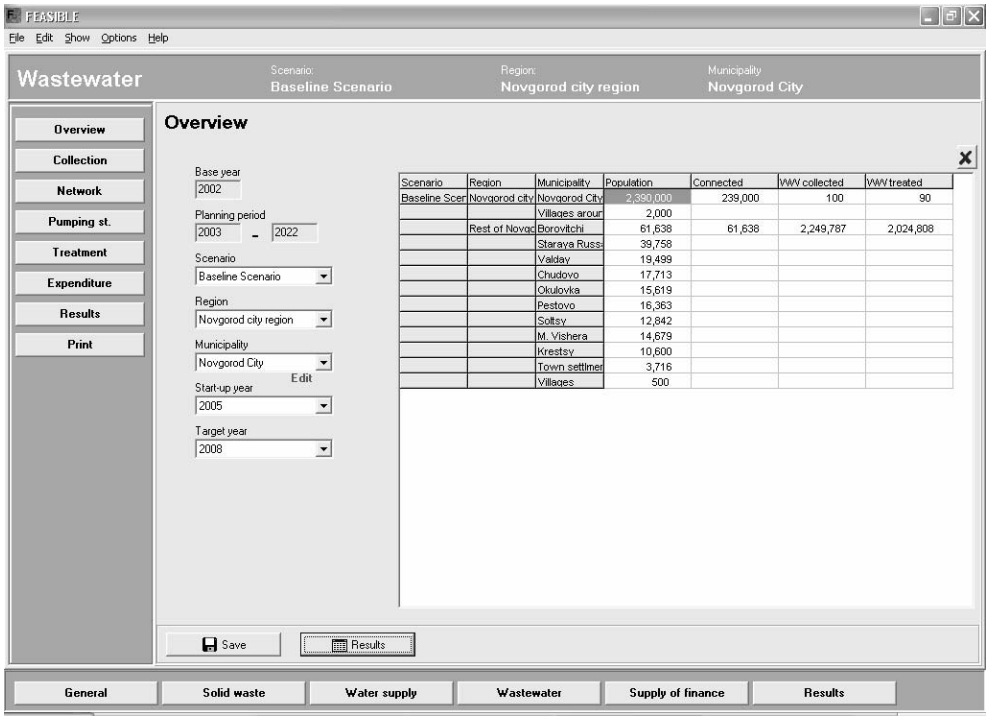
The structure of the wastewater module is very similar to that of the water supply module. The opening screen is the same.

6.1 Overview



In this screen, select the scenario, region and municipality for which data it to be entered or modified.

The *Results* button opens new screen with summary of some wastewater inputted data.

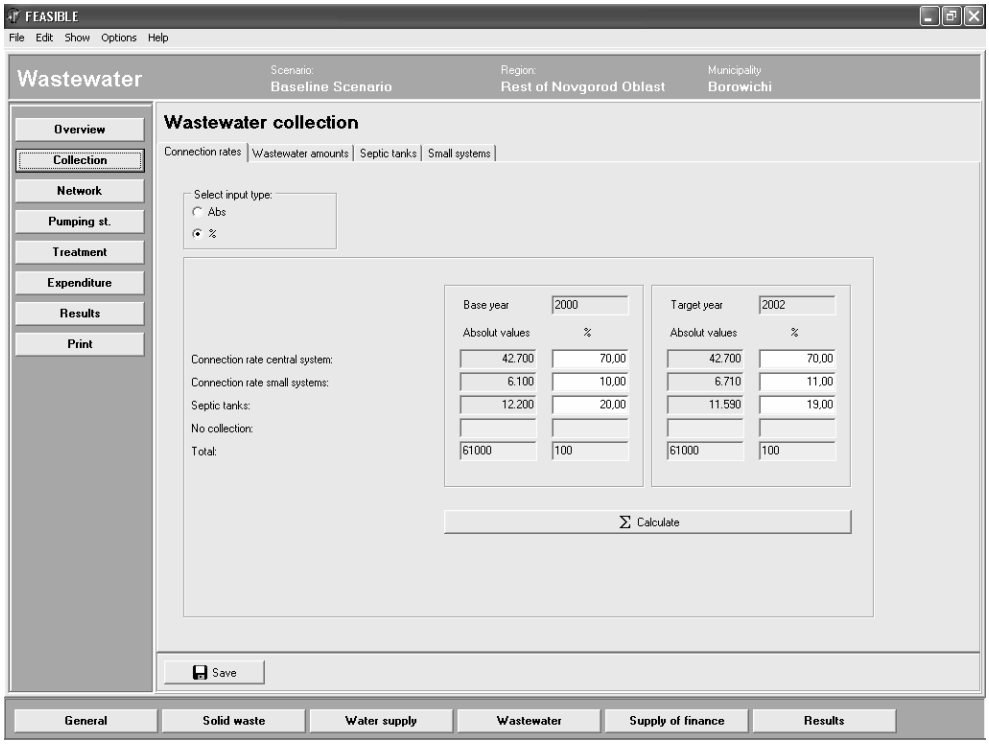


6.2 Collection

The *Wastewater* collection screen includes 4 sub-screens:

- Connection rates
- Wastewater amounts
- Septic tanks
- Small systems

Start by choosing the format of input, i.e. either absolute number of inhabitants connected various systems or the percentage share of total inhabitants in the municipality.



The options as to connection are:

- to the central collection sewerage network;
- to small decentralised systems;
- to septic tanks; or
- no collection.

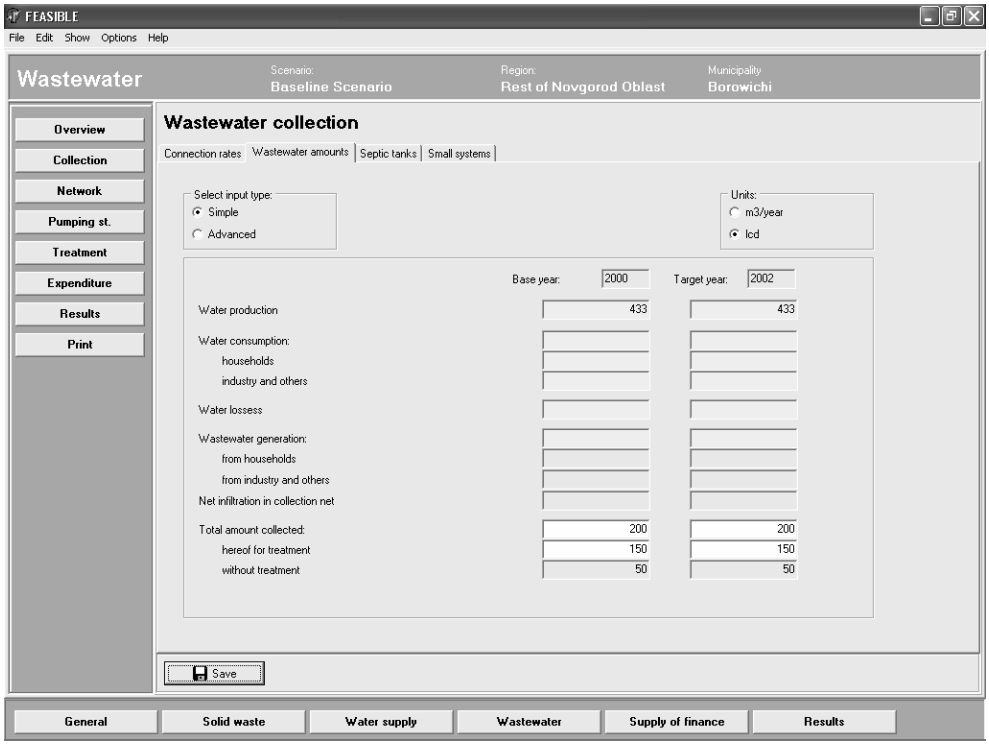
Upon entering the data, activate the button ∑ *Calculate* to fill in the complementary data.

Wastewater amounts

The sub-screen *Wastewater amounts* is similar to the *water production* sub-screen of the *Water supply* module (section 5.1). Start by choosing *Simple* or *Advanced* data input type. *Advanced* can only be selected if the advanced format has also been selected for water supply for the same municipality.

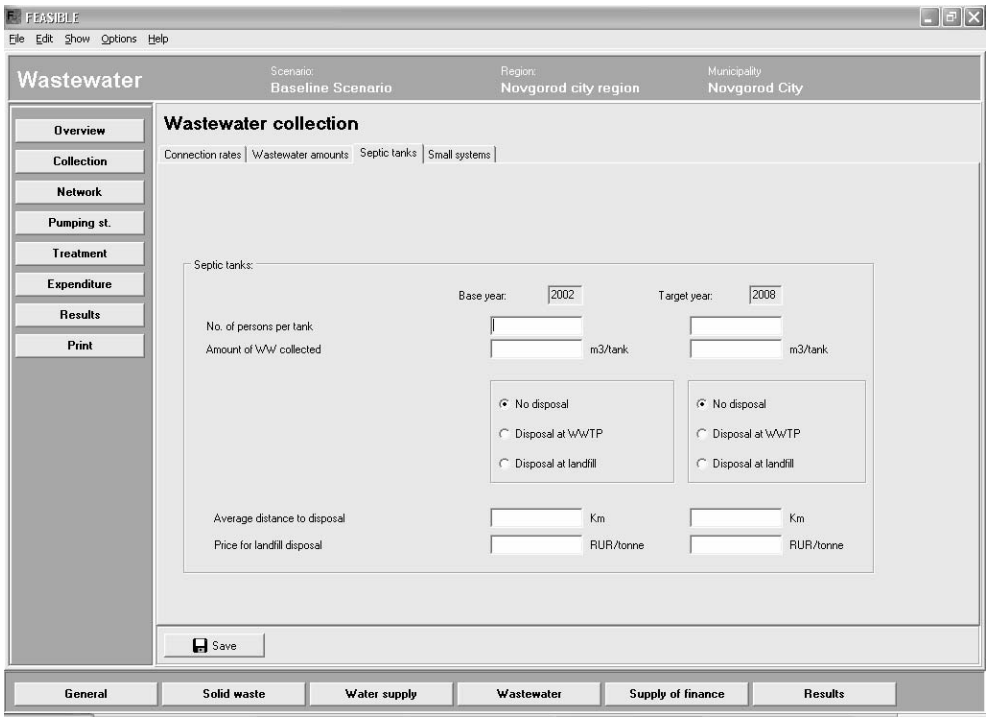
- If the *simple input* option is selected, enter only the amount of wastewater collected in the base year and the target year.

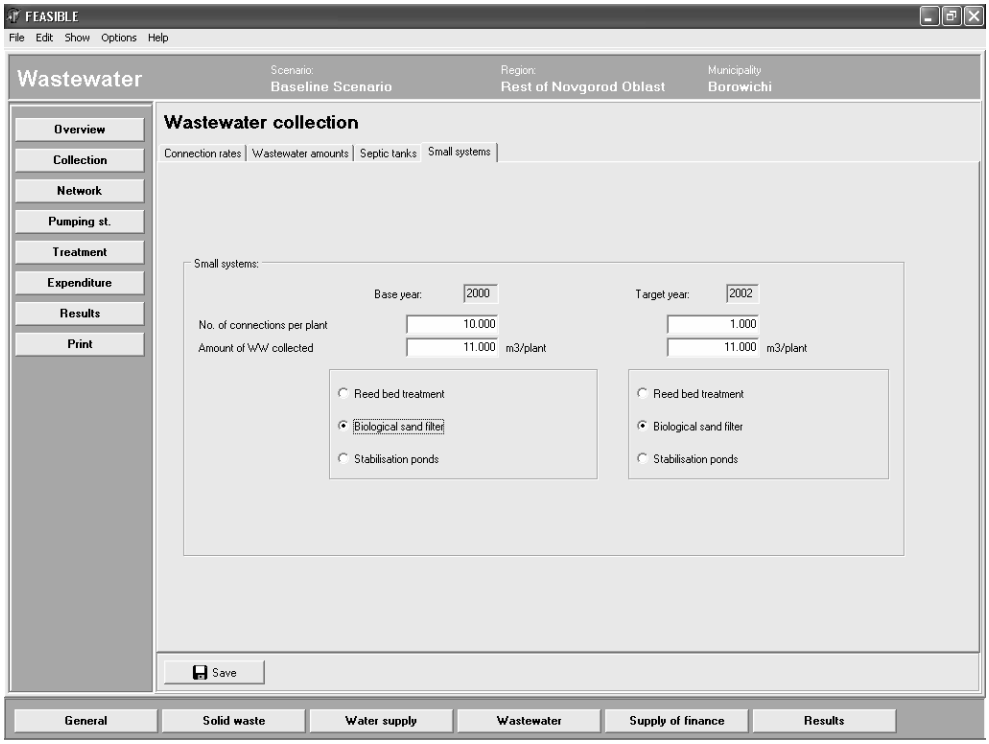
- If the *advanced input* option is selected, FEASIBLE provides a simplified water balance table, enabling pre-model analysis. A pre-model analysis of water production and wastewater collection has to take place to validate the consistency of the data. Before entering data, select *Unit* to define the total annual wastewater collected in either m^3 or litre per capita per day (ldc).



Septic tanks

The third sub-screen comprises input data on septic tanks. The number of persons connected per tank will usually be the average household size, as there is typically one tank per house. The collected amount is the total amount for the persons using the tank.





Small systems

Input on small systems comprises the number of persons connected and the total amount of wastewater collected and treated in the system. The options for the small systems are:

- reed bed treatment;
- biological sand filters; and
- stabilisation ponds.

See **Appendix 3** for technical details on the technologies.

6.2.1 Network

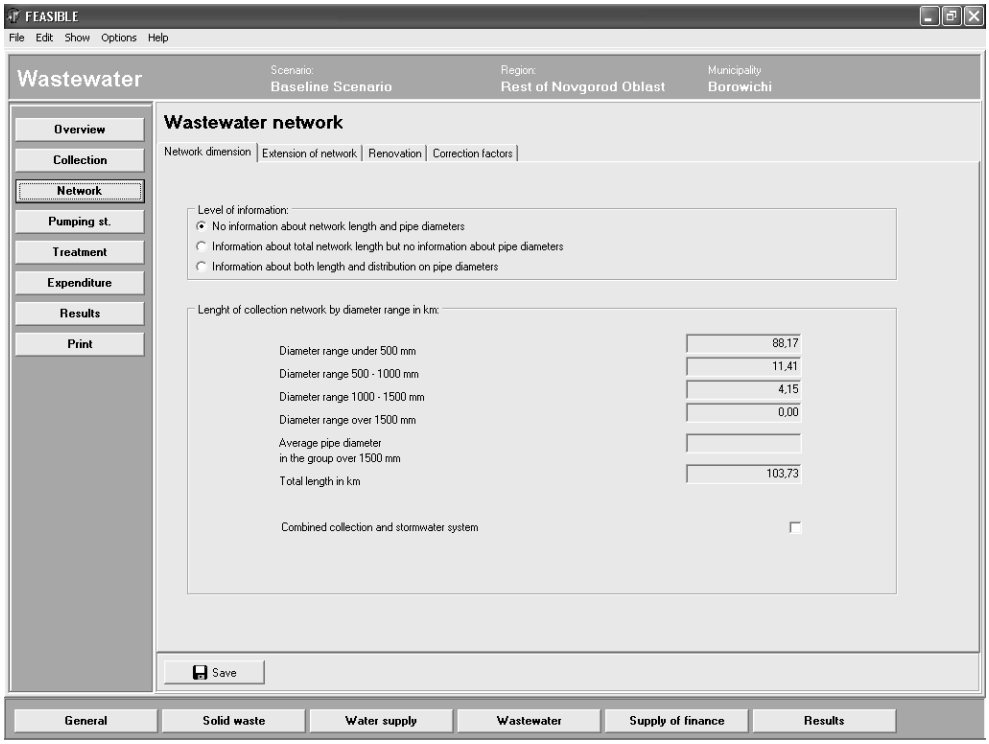
Input needed for *Wastewater network* is similar to that needed for *Water network* (section 5.3), only here the pipes are divided into four size groups.

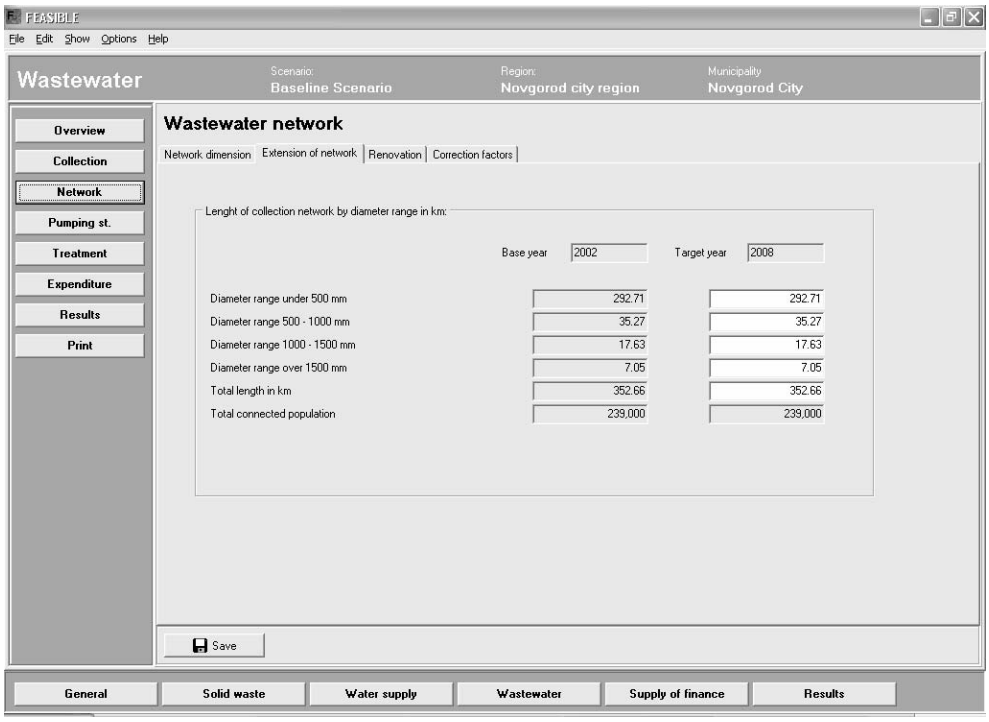
The user chooses between the three levels of data and information availability:

1 No specific information is available about the pipes. FEASIBLE should use default values.

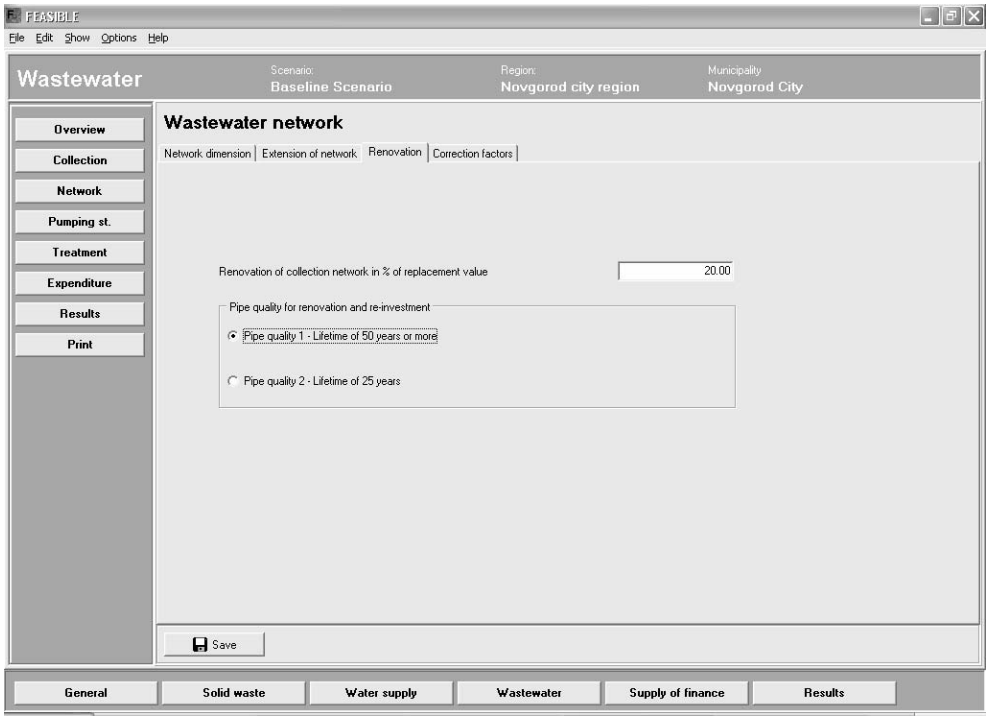
2 The total length of the collection network is known. FEASIBLE should distribute the total length on diameter groups based on default values.

3 Data on the length of different pipe diameters is available.

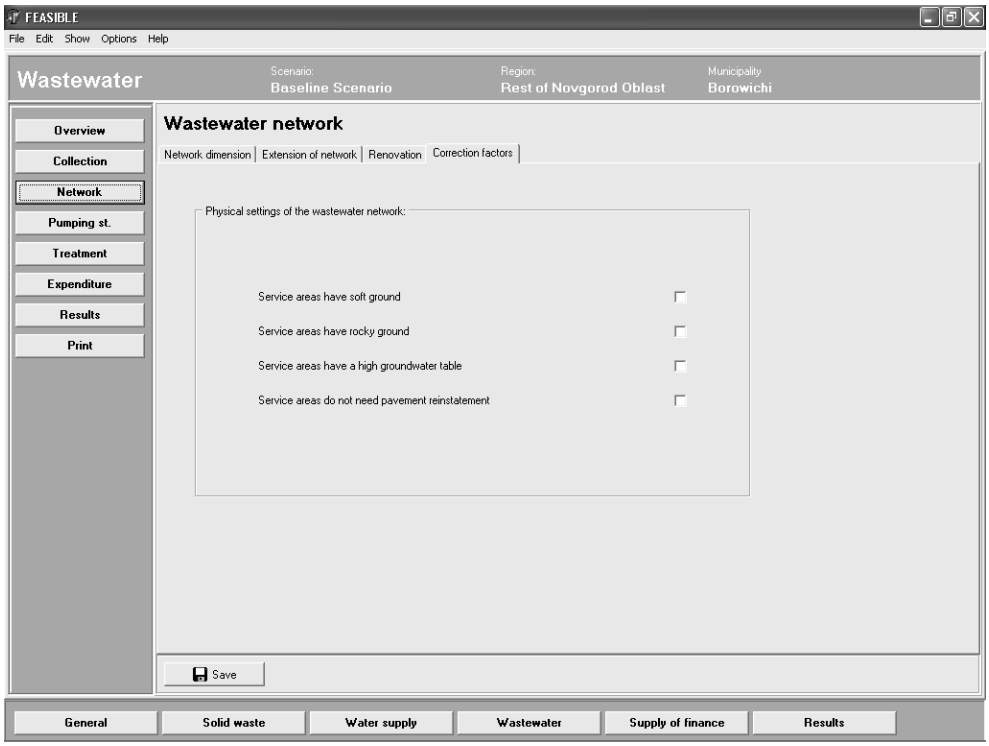




Having made the choice and entered data, the user proceeds to the second sub-folder if the second or third option was selected. In *Extension of network*, data on pipe length in the target year is calculated by FEASIBLE. If the user has better data, the values displayed may be replaced by the user.



In the third sub-folder, indicate the type of pipe quality used. Data on renovation is only required if renovation project is planned for implementation by the target year.

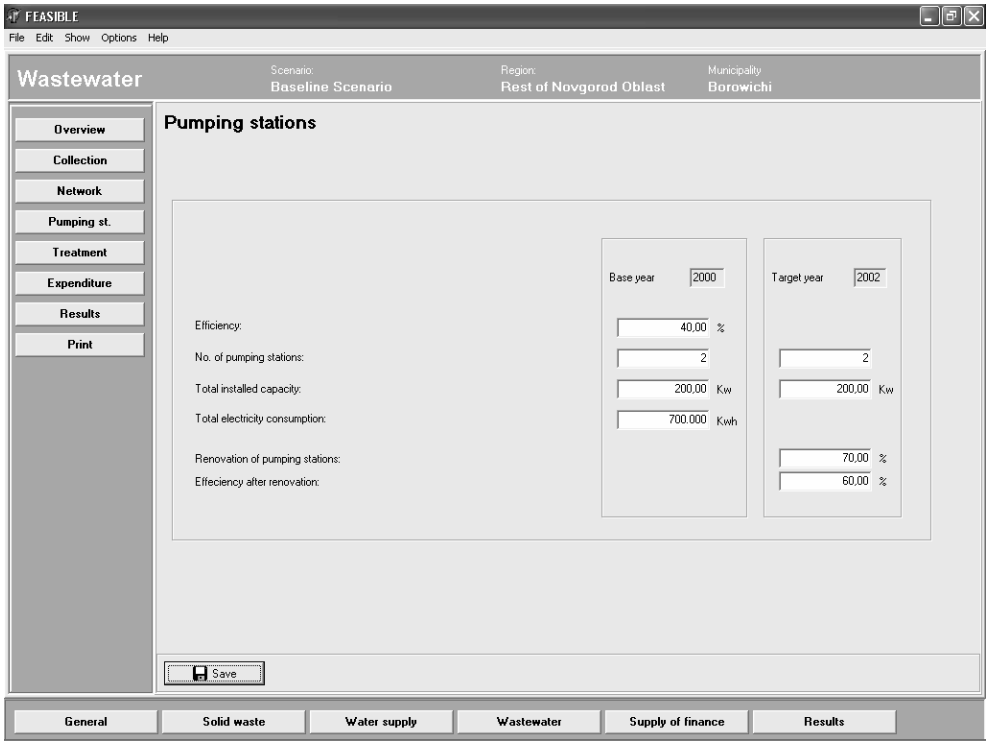


Finally, the last sub-folder is optional and allows entry of specific technical correction factors which can influence the network expenditure.

6.2.2 Pumping Stations

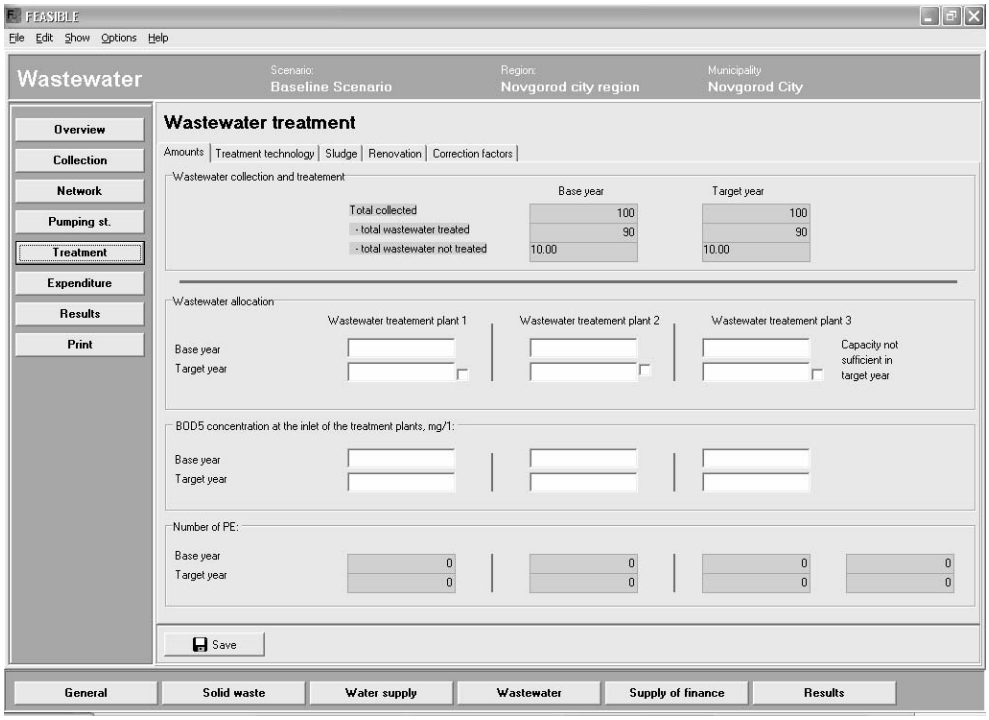
The folder *Pumping Stations* allows specification of a key data on the extent of wastewater pumping. Such data comprises:

- number of pumping stations,
- total installed capacity (total for all pumping stations)
- total energy consumption for wastewater pumping
- energy efficiency (before and after renovation)
- renovation percentage (optional)



6.2.3 Wastewater Treatment

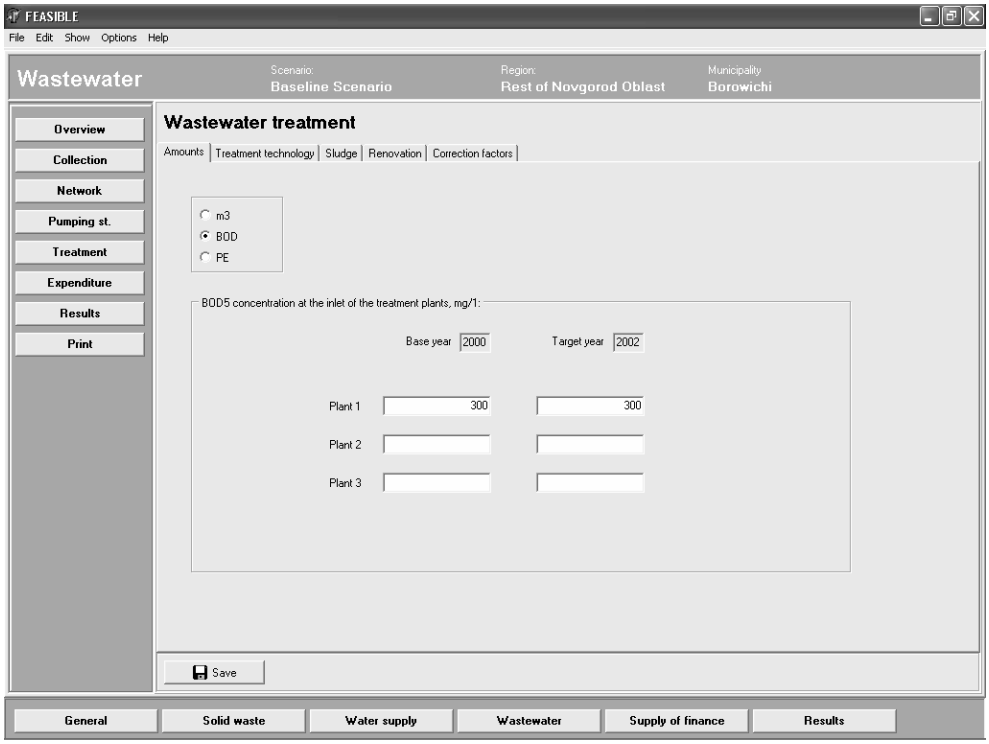
Wastewater treatment includes five sub-folders all related to the input on major wastewater treatment plants. Data on small plants is given in the sub-folder *Small systems* under *Collection.*



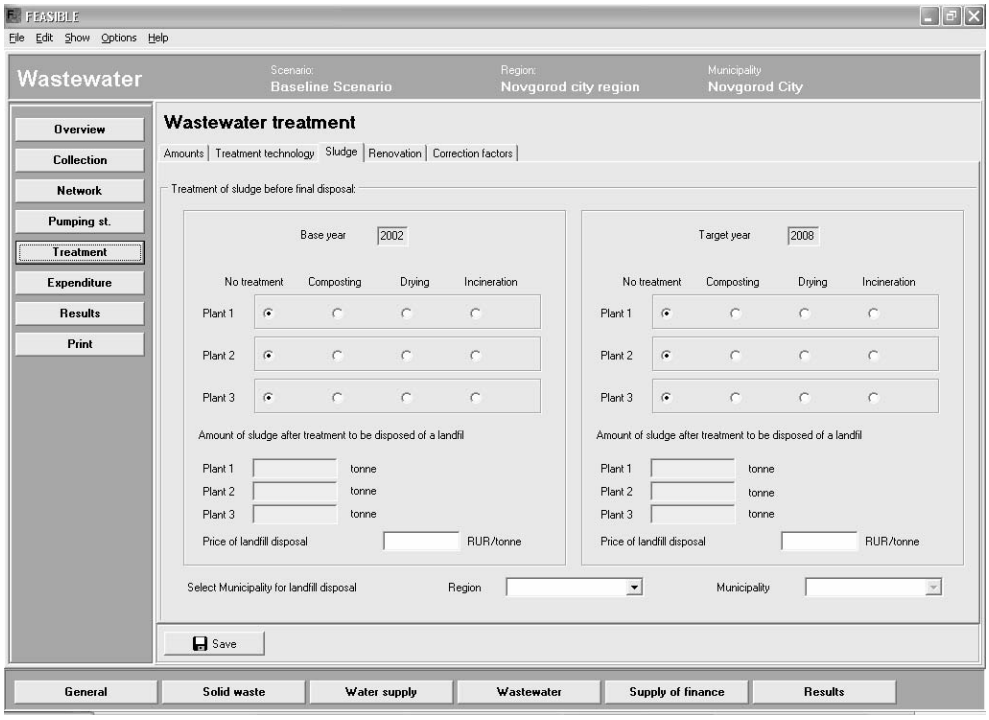
The starting folder includes data on the amount of wastewater being treated. It is possible to specify data for three plants. This allows description of a situation in which different technologies are applied in the municipality.

In the upper part of the screen *Wastewater collection and treatment* data have to be entered in m^3. In section *Wastewater allocation* it can be entered in m^3or it may be data representing the relative distribution among the three plants.

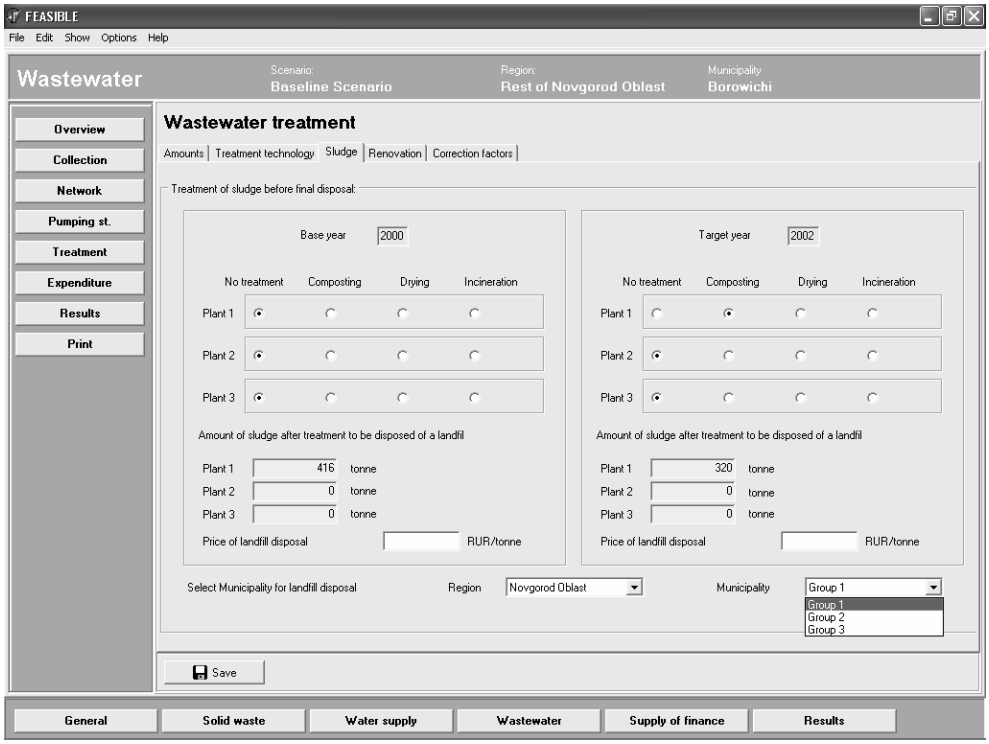
Further, the data on BOD concentrations in the wastewater have to be inputed. Based on the input, FEASIBLE will calculate the total BOD load at each plant.



The second sub-screen, *Treatment technology*, includes the specification of treatment technology. For more details, see Appendix 3.

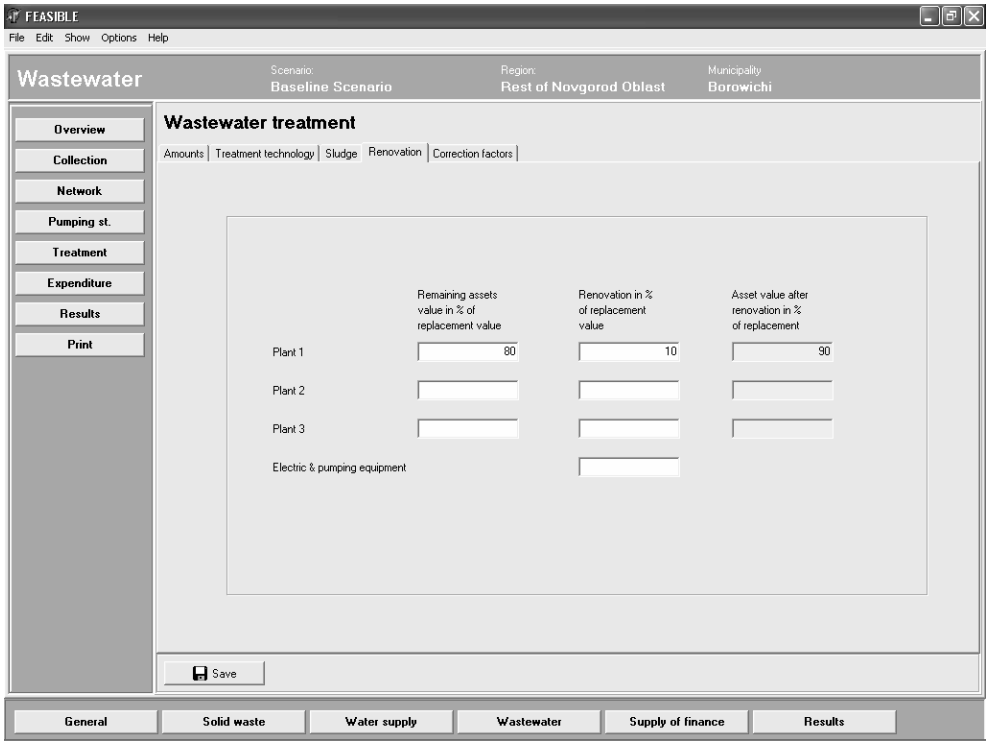


Sludge requires specification of the treatment of the sludge from the wastewater treatment plant. There are four options for sludge handling.



- No treatment (all the sludge is transported and disposed at a landfill);
- Composting (residual amount is transferred to a landfill);
- Drying (residual amount is transferred to a landfill); or
- Incineration (residual amount is transferred to landfill).

The amount of sludge to be disposed of is transferred to the *Solid Waste* module.



In the folder *Renovation*, the only required input is an estimate of the remaining value of the wastewater treatment plant. The format is the current assets value in percentage of the replacement value. It is possible - but optional - to specify a renovation percentage. If the current asset value is 50% of the replacement value and a renovation project of 20% also of the replacement value, the asset value will increase to 70% after finalising the project.

The last sub-screen called *Correction factors* also includes possibility to apply a number of technical correction factors representing different local conditions.

6.2.4 Additional Expenditure (optional)

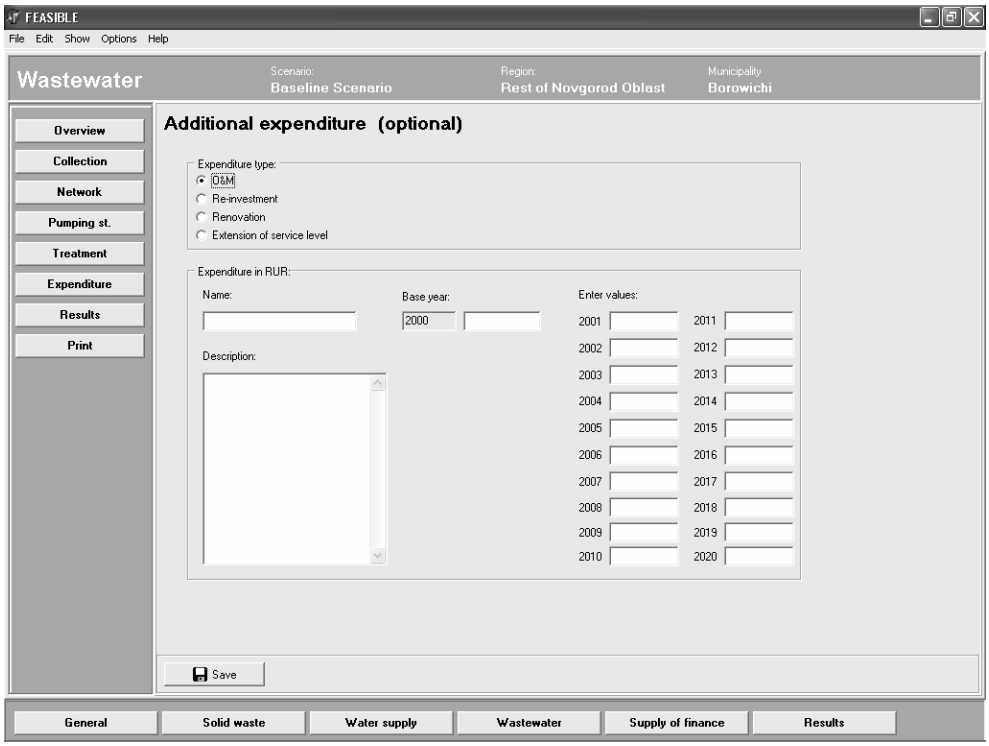
Input in the *Additional expenditure* screen is optional. It may be used in two types of situations:

- to include expenditure resulting from a type of wastewater infrastructure or service not included in FEASIBLE; or

- to correct or modify the cost estimates for a particular municipality.

In order to modify the results calculated by FEASIBLE, enter negative or positive values for the type of expenditure in question.

The expenditure should be expressed in the national currency and in fixed or current prices as selected by the user in *General, Area, Inflation rate*.



7 User Manual - Municipal Solid Waste Module

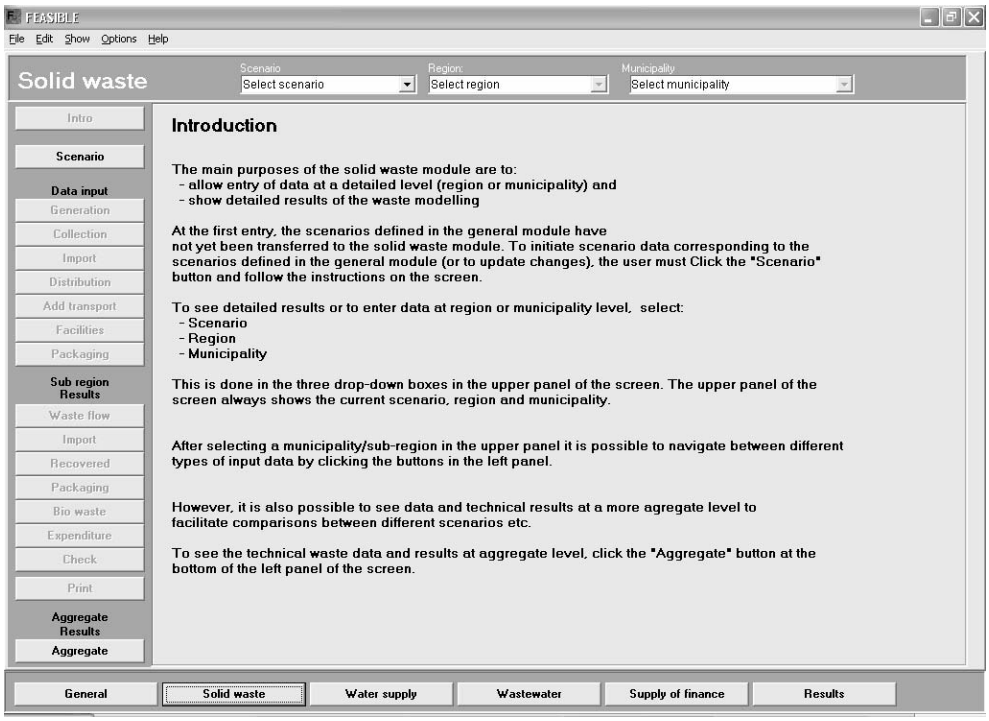
This chapter describes how to use the MSW module, the main purposes of the which are to:

- allow entry of data at a detailed level (region or municipality) and
- show detailed results of the waste modelling

The detailed modelling assumptions behind the calculation of waste flow and expenditure needs are presented in Appendix 4.

7.1 Entering the MSW Module

At the first entry, the following screen will appear:


FEASIBLE
File Edit Show Options Help
Solid waste
Scenario
Select scenario
Region:
Select region
Municipality
Select municipality
Intro
Scenario
Data input
Generation
Collection
Import
Distribution
Add transport
Facilities
Packaging
Sub region Results
Waste flow
Import
Recovered
Packaging
Bio waste
Expenditure
Check
Print
Aggregate Results
Aggregate
Introduction
The main purposes of the solid waste module are to:
- allow entry of data at a detailed level (region or municipality) and
- show detailed results of the waste modelling
At the first entry, the scenarios defined in the general module have not yet been transferred to the solid waste module. To initiate scenario data corresponding to the scenarios defined in the general module (or to update changes), the user must Click the "Scenario" button and follow the instructions on the screen.
To see detailed results or to enter data at region or municipality level, select:
- Scenario
- Region
- Municipality
This is done in the three drop-down boxes in the upper panel of the screen. The upper panel of the screen always shows the current scenario, region and municipality.
After selecting a municipality/sub-region in the upper panel it is possible to navigate between different types of input data by clicking the buttons in the left panel.
However, it is also possible to see data and technical results at a more agregate level to facilitate comparisons between different scenarios etc.
To see the technical waste data and results at aggregate level, click the "Aggregate" button at the bottom of the left panel of the screen.
General
Solid waste
Water supply
Wastewater
Supply of finance
Results

The scenarios defined in the general module have not yet been transferred to the MSW module. To initiate scenario data corresponding to the scenarios defined in the general module (or to update changes), click the *Scenario* button and follow the instructions on the screen

7.1.1 Upper Panel

The upper panel shows the active scenario, region and municipality. To see detailed results or to enter data at region or municipality level, select:

- Scenario
- Region
- Municipality

This is done in the three drop-down boxes in the upper panel of the screen.

The upper panel of the screen always shows the scenario, region and municipality currently active.

7.1.2 Left Panel

The left panel contains the main functionalities of the MSW module. Each button in the left panel activates a new screen or group of screens with a common purpose. The screens may be activated in the desired order. FEASIBLE automatically updates the underlying calculations and screens, when needed.

After selecting a municipality/ region in the upper panel, it is possible to navigate between different types of input/output data by clicking the buttons in the left panel. There are three types of buttons:

1 Data input
2 Results
3 Scenario manager

A brief overview of these buttons and their functionality is given in the tables below. Sections 7.3 - **Error! Reference source not found.** describe the functionality and required user input in detail.

Table 7-1 Data input functionalities and screens

Generation	Shows waste generation screen. Enter waste amount and composition in the base year. Minimum required input: Amount of waste generated in the base year
Collection	Shows waste collection screen. Specify waste collection system. Minimum required input: None. (Default: Kerbside ordinary collection)
Import	Specify possible waste import from other municipalities Minimum required input: None. (Default: No import from other municipalities)
Distribution	Specify waste distribution on available recovery and disposal facilities Minimum required input: None. (Default: All waste is sent to a controlled landfills)
Add transport	Specify additional transport related to waste collection, beyond what is already included in the standard expenditure functions. Minimum required input: None. (Default: No additional transport)
Facilities	Specify existing and new recovery and disposal facilities. Minimum required input: Sufficient capacity to process collected waste.
Packaging	Specify share of packaging waste in collected/generated waste. Minimum required input: None. (Default shares)

Table 7-2 Result screens

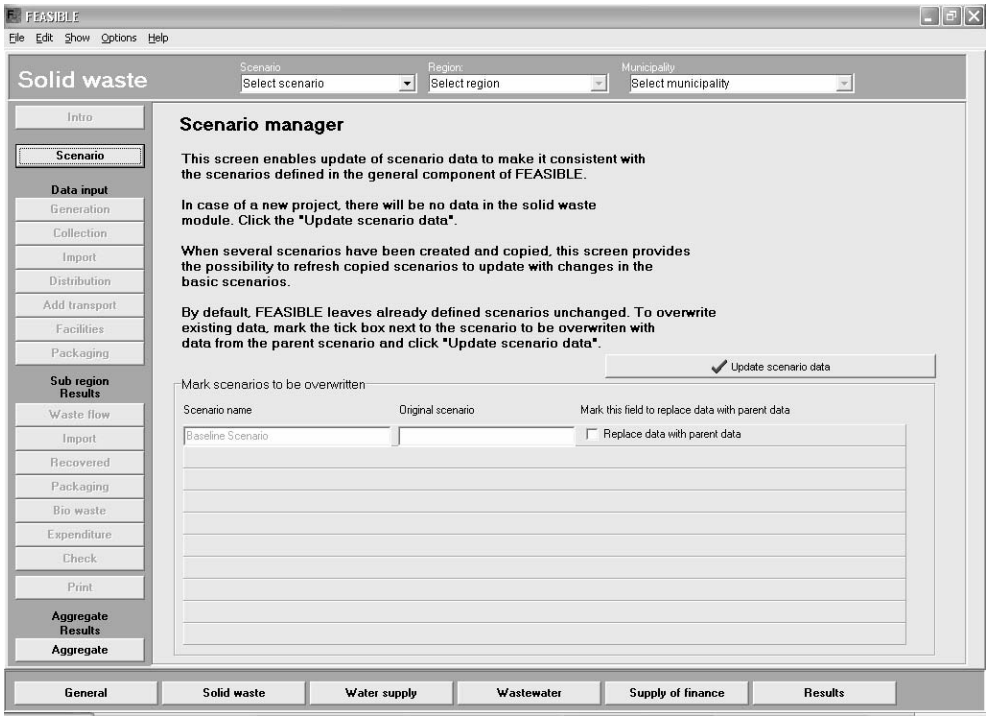
Waste flow	View waste flow calculated by FEASIBLE. Possibility to export data to Excel
Import	View amount of waste imported to the current municipality from other municipalities.
Recovered	View waste recovery and revenue from waste recovery. Input: Local sales prices of recovered waste and energy
Packaging	View recycling and recovery of packaging waste calculated by FEASIBLE.
Bio waste	View results calculated by FEASIBLE regarding landfilling of biodegradable waste.
Expenditure	View expenditure indicators calculated by FEASIBLE. Transfer expenditure to main part of FEASIBLE
Check	View waste flow calculated by FEASIBLE. for the current municipality to check consistency of calculation.
Print	Print a set of predefined reports showing key data input and results for the current municipality
Aggregate	Show overall results, compare scenarios, regions etc.

7.2 Scenario Manager (Solid Waste)

Update Scen

This screen enables update of scenario data to make it consistent with the scenarios defined in the general component of FEASIBLE.

The Update Screen function should be used to transfer general scenario data from the general component to the MSW module, at the first entry. In addition, the function should be used when changes have been made in scenarios in the general component.



When first entering the MSW module, click the *Update scenario data* button to set up needed database files for the scenarios defined in the general component.

When several scenarios have been created and copied, this screen will provide the possibility to refresh copied scenarios to update with changes in the basic scenarios.

By default, FEASIBLE leaves already defined scenarios unchanged. To overwrite existing data, mark the tick box next to the scenario to be overwritten with data from the parent scenario and click the Update Scenario Data button.

7.3 Generation

Generation

Required input: Amount of waste generated in the base year for each source of waste.

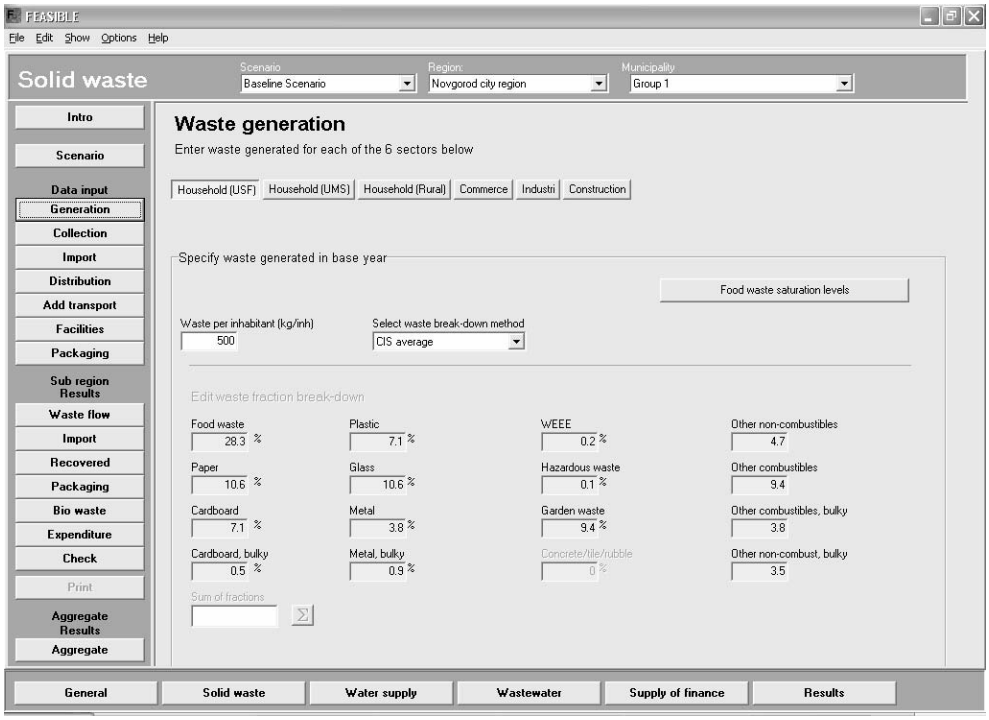
The Generation button activates the following screen:

There are six sub screens, one for each source:

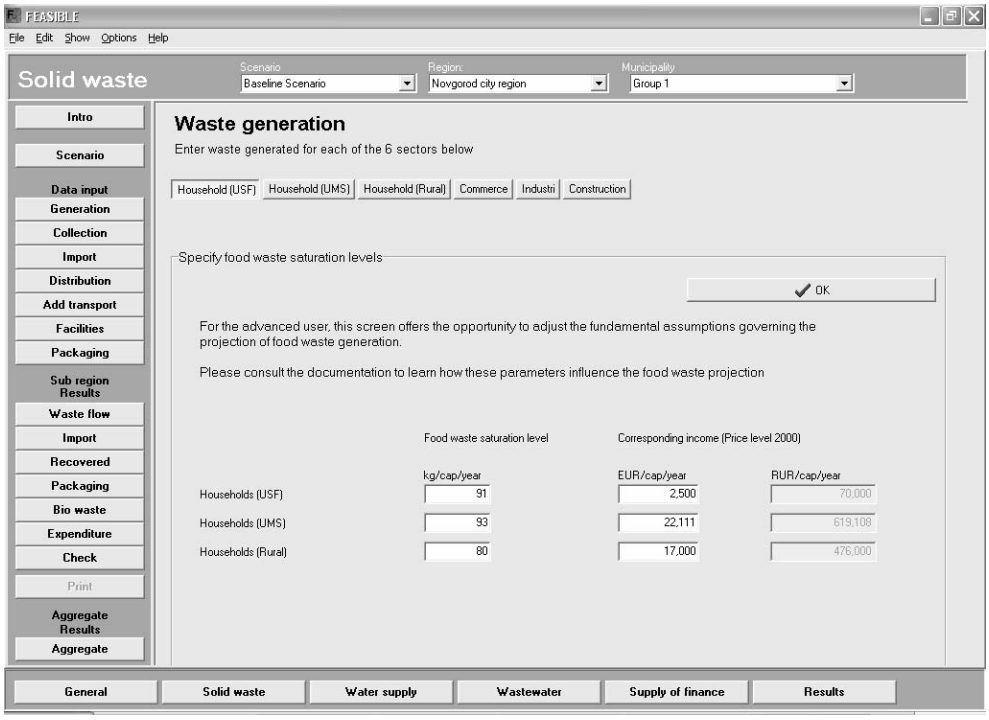
- Urban single-family (USF) households
- Urban multi-storey (UMS) households
- Rural households
- Service, commerce and institutions
- Industry
- Construction

The sub-screen for Household (USF) is shown below. The screens for other sources are very similar.

In this screen, enter the amount of waste in the base year and specify the waste composition (break-down on waste fractions). This can be done by selecting one of three predefined waste fraction break-down options or entering a user defined break-down.



For the advanced user, this screen offers the opportunity to adjust the fundamental assumptions governing the projection of food waste generation. This facility is available by clicking the food waste saturation level button which activates the following sub-screen.



In this screen, adjust food waste saturation levels and corresponding income as desired and click OK to accept the changes.

FEASIBLE projects the generation of food waste by comparing the situation in the region/municipality modelled with the situation in the EU in 2002. FEASIBLE contains a fixed point of reference (EU, 2002) describing the relation between the GDP (or GRP) per capita and food waste generation. This fixed point is different for each household type as illustrated in screen above.

FEASIBLE assumes a linear development of the relation between GDP/capita and food waste generation. The food waste generation in a given year is thus determined by the GDP/capita in that year.

7.4 Collection

Collection

Specification of collection system is optional. If no collection system is specified, FEASIBLE assumes that the waste is collected by simple kerbside collection.

The waste collection screen is shown below

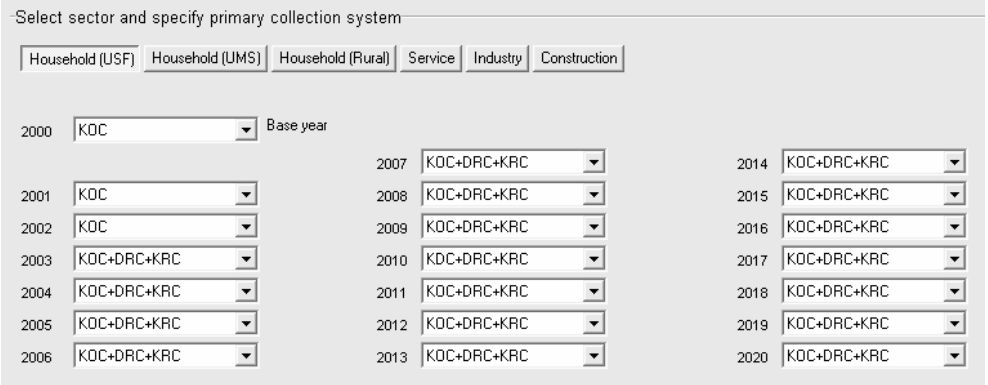
This screen contains five sub-screens:

- Primary collection system
- Secondary collection system
- Coverage of secondary collection system
- Waste not collected
- Collection frequency

Primary collection system

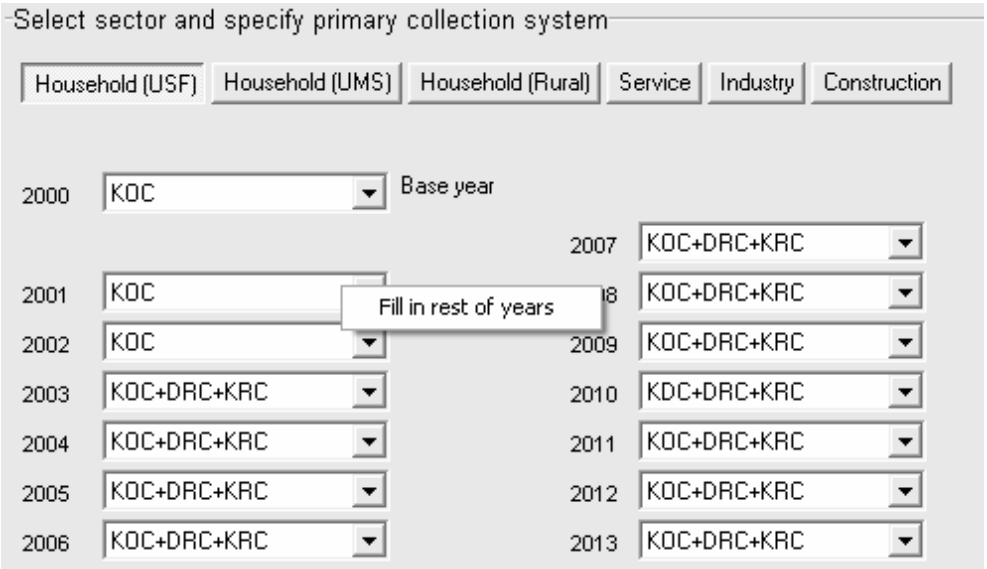
In the first screen, it is possible to specify the primary collection systems. Separate collection systems have to be specified for each of the six sources. For each source, the default collection system is kerbside ordinary collection.

To specify the primary collection system for urban households in single family houses, click Primary collection system, followed by Households (USF),. after which the following screen will appear.



Specify collection systems as needed for each year by selecting the relevant system from the drop-down lists. If a system is to remain unchanged after a specific year, the model can fill in the fields for the subsequent years automatically. Just right-click the relevant year and select Fill in rest of years" on the pop-up menu.

If, for instance, the user was to right-click the field for 2001, in the example below and select Fill in rest of years, the input for all years from 2001 to 2020 would be changed to "KOC".



Secondary collection system

In the second sub-screen, a secondary collection system can be specified. This screen offers exactly the same opportunities as the Primary collection system sub-screen.

Coverage of secondary collection system

In the third screen, the coverage of the secondary collection system has to be entered. It is possible to define separate coverage for each of the six sources. If coverage of secondary system is set at "0" (Default), only the primary system will be active.

Enter coverage of secondary collection system (%)

Waste source	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Households USF	0	0	0	0	0	0	0	0	0	0	0	0	0
Households UMF	0	0	0	0	0	0	0	0	0	0	0	0	0
Households R	0	0	0	0	0	0	0	0	0	0	0	0	0
Commerce	0	0	0	0	0	0	0	0	0	0	0	0	0
Industry	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0

This screen also includes the option to fill in remaining years automatically (see description of primary collection system above.

Waste not collected

In the fourth sub-screen, the share of waste not collected by the collection systems has to be entered. It is possible to define separate coverage for each of the six main sources. For instance, in the example above, 22% of the waste from Households USF (urban single family households) was not collected in 2000.

Enter share of waste not collected (%)

Adjust collection fre	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
USF	22	16	11	10	5	0	0	0	0	0	0	0	0
UMF	22	16	11	10	5	0	0	0	0	0	0	0	0
R	11	11	11	15	15	15	15	15	15	15	15	15	15
Comm	30	26	22	18	12	8	4	0	0	0	0	0	0
Industry	34	29	24	19	13	9	4	0	0	0	0	0	0
Construction	34	29	24	19	13	9	4	0	0	0	0	0	0

This screen also includes the option to fill in remaining years automatically (see description of primary collection system above.

If collection from households involves kerb-side ordinary collection as the single collection method, bulky waste is assumed not to be collected by default. When filling in the above table, the share of waste, which is not collected because it is bulky waste should be taken into account.

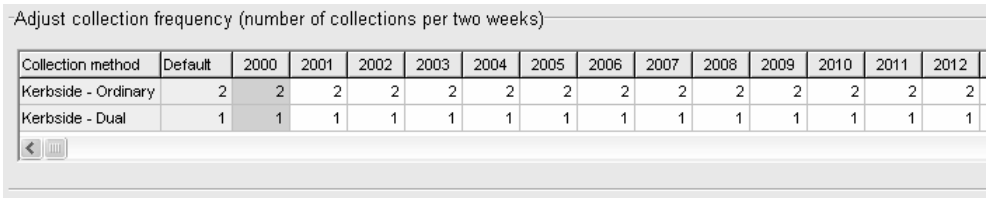
For example, if the total waste not collected is 20% and bulky waste not collected is 5%, the figure to be entered in the above table is 15%.

Lover part of the screen shows the share of bulky waste not collected

Collection frequency

In the fifth sub-screen, the collection frequency of the collection systems can be changed. (Changes will only affect urban households in multi-storey houses). It is possible to change the collection frequency for Kerbside ordinary and Dual collection. Please note that the collection frequency here is defined as number of collections per **two weeks**, i.e. "1" means once every second week, while "2"

means twice every **two weeks**, i.e. once a week.. (Default, "Ordinary collection" is set at once every week, while "Dual collection is set at once every second week.).


Adjust collection frequency (number of collections per two weeks)
Collection method | Default | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012
Kerbside - Ordinary | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2
Kerbside - Dual | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1

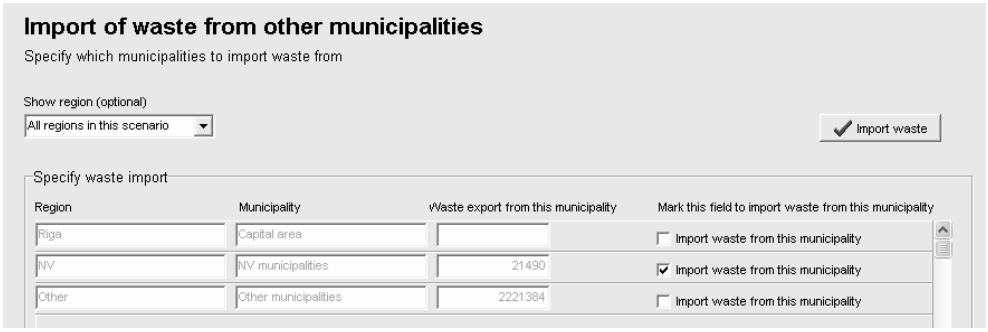
This screen also includes the option to fill in remaining years automatically (see description of primary collection system above.

7.5 Waste Import

Import

Waste import is optional. (Default: there is no waste import). However, if waste is exported from some municipalities, this waste needs to be imported to other municipalities to maintain the balance in the total waste flow. (See section 7.6 for a description of how to export waste).

Click the Import button to show the following screen.


Import of waste from other municipalities
Specify which municipalities to import waste from
Show region (optional)
All regions in this scenario
Import waste
Specify waste import
Region | Municipality | Waste export from this municipality | Mark this field to import waste from this municipality
Riga | Capital area | | Import waste from this municipality
NV | NV municipalities | 21490 | Import waste from this municipality
Other | Other municipalities | 2221384 | Import waste from this municipality

The idea behind the import facility is to allow import of waste from other municipalities to the current municipality. The screen lists the municipalities defined in the current scenario and shows which of these municipalities have waste export.

To import waste, select the municipalities from which waste is to be imported, and click the Import waste button. The imported waste is added to the waste generated in the current municipality. The waste import will remain active until the import settings are changed.

To remove waste import untick import waste from this municipality, where relevant, and click the Import waste button to recalculate waste import.

There is no automatic update of waste import data. If the waste export is changed, it is necessary to subsequently update waste import figures.

7.6 Waste Distribution

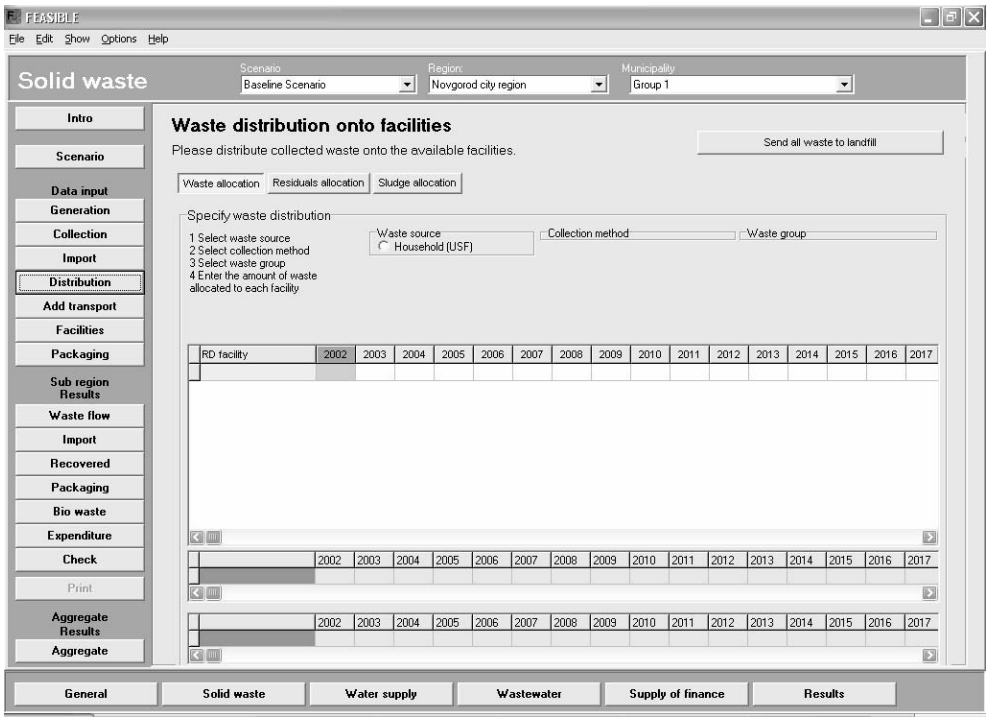
Distribution

The waste distribution screen contains three sub-screens:

- Waste allocation shows the general waste allocation sub-screen
- Residuals allocation allows specification of the type of landfill type to which residuals should be sent.
- Sludge allocation

Waste allocation

All collected waste needs to be distributed on the available recovery and disposal technologies or exported for treatment in another municipality. This is done in the Waste allocation sub-screen.



Fill in the table for each combination of Waste source, Collection method and Waste group. This is done in the following way:

Step 1: Select the waste source. Now the relevant collection methods will be shown..

Step 2: Select the collection method. The relevant waste groups will be given.

Step 3: Select waste group. Possible recovery and disposal technologies are shown for the chosen combination of source, collection method and waste group).

Step 4: Enter the allocation in the table. Please note that the model allocates waste to the recovery and disposal technologies proportionally to the figures

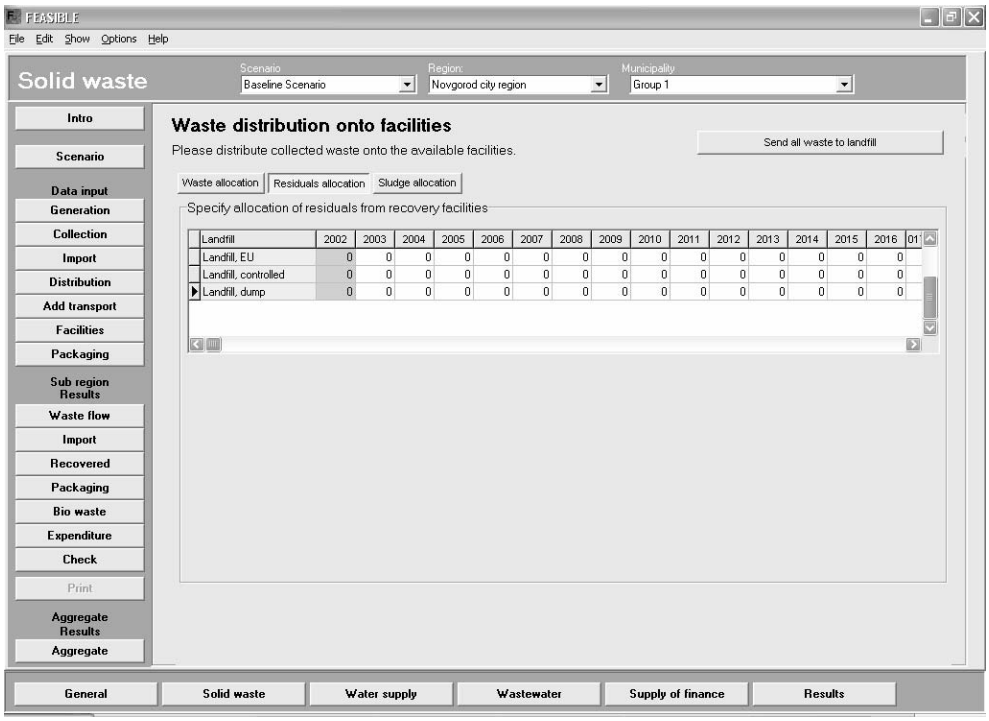
given in the table. In other words, it does not matter whether the allocation is entered in absolute figures or in percentages.

This screen also includes the option to fill in remaining years automatically (see description of primary collection system above. Furthermore, it is possible to allocate all waste (except residuals) to one of the three types of landfills by clicking Send all waste to landfill in the upper right corner of the screen.

It is recommended to check that all waste has been allocated. This can be done in the Check screen under Results.

Residuals allocation

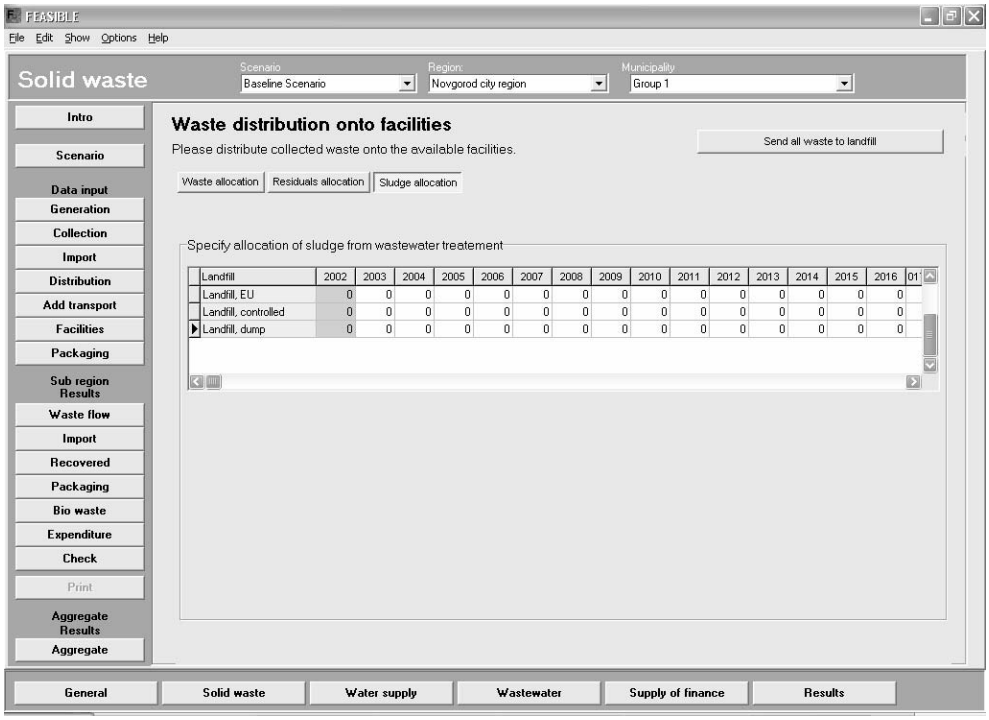
In the residuals allocation screen, it is possible to specify which type of landfill should receive the residuals (e.g. ash from incineration plant).



By default, all residuals are sent to controlled landfills. However, pressing the button *Send all waste to landfill* gives the user an opportunity to change the assumption.

Sludge allocation

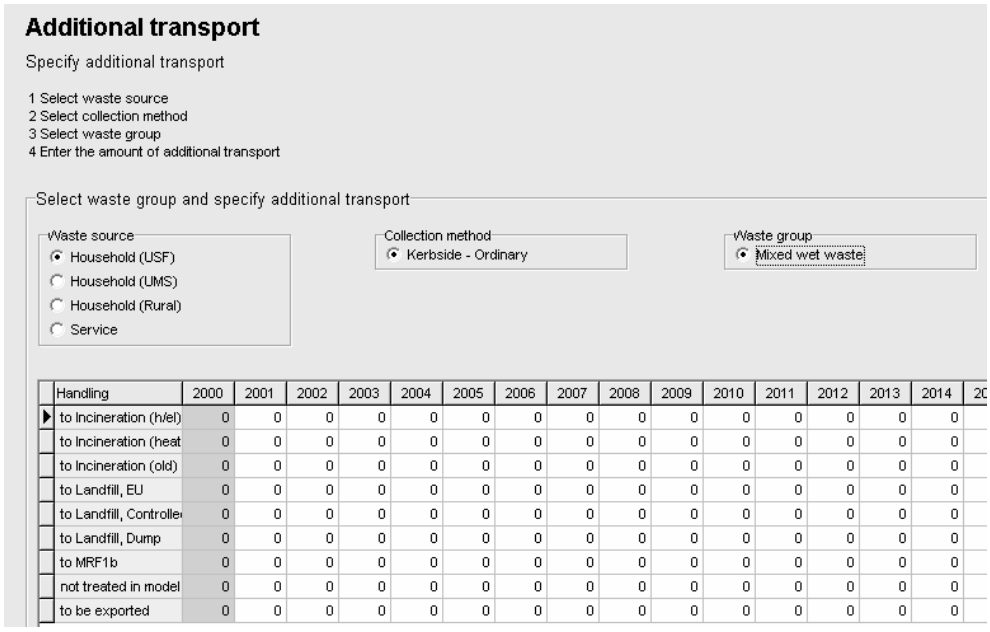
Sludge allocation screen allows for the possibility to specify target landfill for sludge allocation.



7.7 Additional Transport

Add transport

Transport in connection with waste collection is included in the expenditure functions for waste collection. However, if waste has to be transported longer than what is assumed in the cost calculations (cf. Appendix 4, table 3-16), it is possible to specify an additional amount of transport (km).



Specify additional transport for each combination of waste source, collection method and waste group. This is done in the following way:

Step 1: Select the waste source. Now relevant collection methods will be displayed

Step 2: Select the collection method. The relevant waste groups are given.

Step 3 Finally, Select waste group. Possible recovery and disposal technologies are shown for the chosen combination of source, collection method and waste group.

Step 4: Enter the additional km in the table. Please note that FEASIBLE includes a default distance in the calculations (cf. Appendix 4, table 3-16). Additional transport should be specified as the extra transport distance to be added to the figure already included.

7.8 Recovery and Disposal Facilities

Facilities

The purpose of this screen is to enable specification of a capacity of existing and new recovery and disposal facilities which will be sufficient to handle the waste collected.

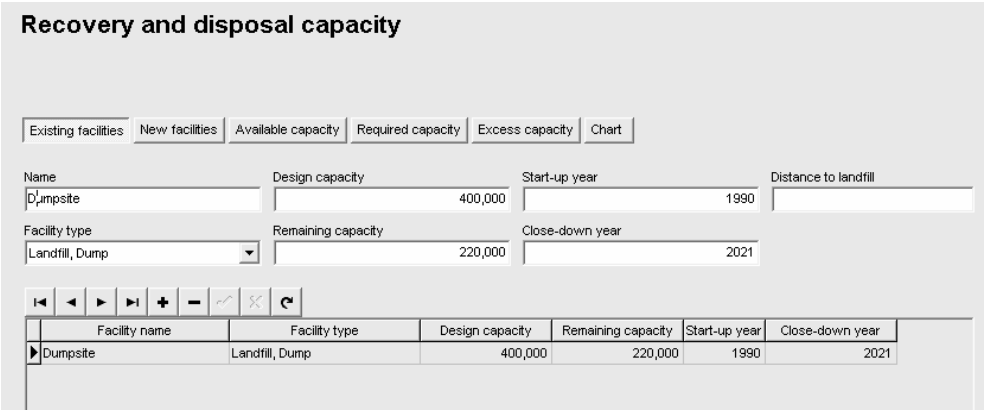
To this end, this screen contains 6 sub-screens:

- Existing facilities (specification of existing facilities)
- New facilities (specification of new facilities)
- Available capacity (shows the capacity of specified facilities)
- Required capacity (shows required capacity)
- Excess capacity (shows the difference between available and required capacity)
- Chart (comparing required capacity with required capacity, year by year)

Only two of these screens are input screens (exiting facilities and new facilities). The rest of the screens are meant to help the user define sufficient capacity to handle the waste collected.

Existing facilities

In this screen, the existing facilities in the base year must be specified.



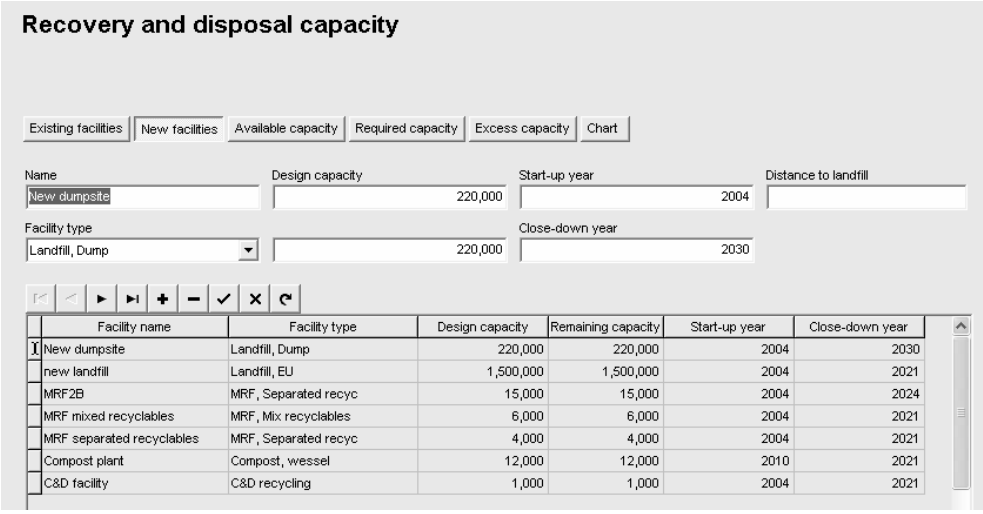
The input part is the white fields in the middle part of the screen. This section of the screen shows only one facility at a time. The grey table in the lower part of the screen provides an overview of the existing facilities already specified, making it easier for the user to navigate through a large number of facilities. This part of the screen is read only.

To add a facility, click the "+" button and specify the characteristics in the white fields. After editing or adding a facility. click the "➨" button to save data.

- *Name* can be a name of the user's own choice
- *Facility type* is selected from the drop-down box
- *Design capacity* is the capacity (tonnes) in the year in which the facility was put into use.
- *Remaining capacity* is the remaining capacity in the base year. For all facilities other than landfills, this should be equal to the design capacity.
- *Start-up year* is the year in which the facility was put into use.
- *Close down* is the year in which the facility is to be closed down.
- *Distance to landfill* is the distance (km) from the facility to the landfill at which the residuals are disposed of.

New facilities

In this screen, it is possible to specify new facilities. This screen is very similar to the Existing facilities screen.



To add a facility, click the "+" button and specify the characteristics in the white fields. After editing or adding a facility, click the "➨" button.

- *Name* can be a name of the user's own choice

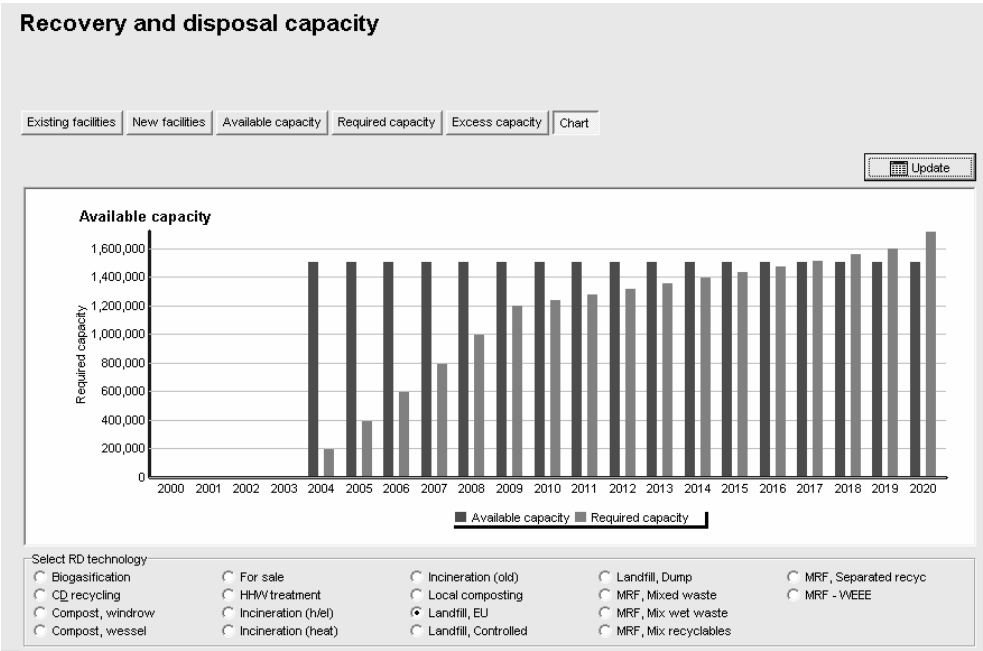
- *Facility type* is selected from the drop-down box
- *Design capacity* is the capacity (tonnes) in the year in which the facility is to be put into use.
- *Remaining capacity* should be equal to the design capacity.
- *Start-up year* is the year in which the facility is to be put into use.
- *Close down* is the year in which the facility is to be closed down.
- *Distance to landfill* is the distance (km) from the facility to the landfill at which the residuals are to be disposed of.

Available capacity — This screen shows the available capacity from the specified facilities in tonnes.

Required capacity — This screen shows the required capacity measured in tonnes. The figures are calculated by FEASIBLE based on the user input in the waste distribution screen (see section 7.6). Note that the required capacity from landfills is accumulated over time.

Excess capacity — This screen shows the difference between available and required capacity.

Chart — This screen shows a graphical presentation comparing available capacity with required capacity over time.

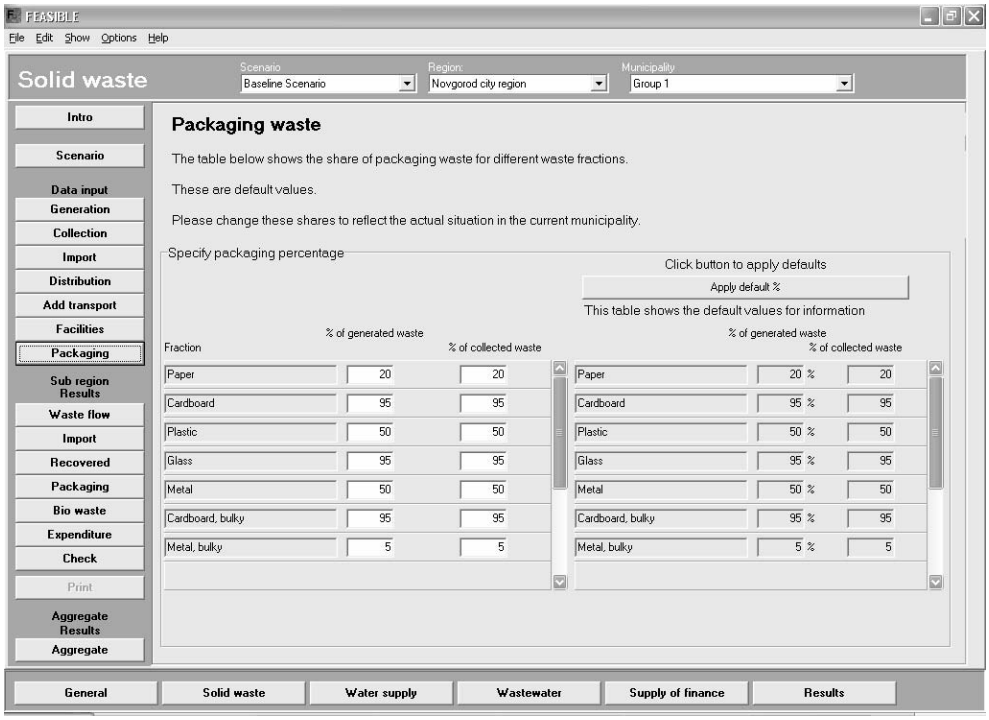


Click the Update button to update background data and then select the type of facility in the box below the chart.

7.9 Packaging Waste

Packaging

The purpose of this screen is to enable specification of the share of packaging waste in generated and collected waste for certain fractions. This input is used in the calculations on recycling and recovery of packaging waste.

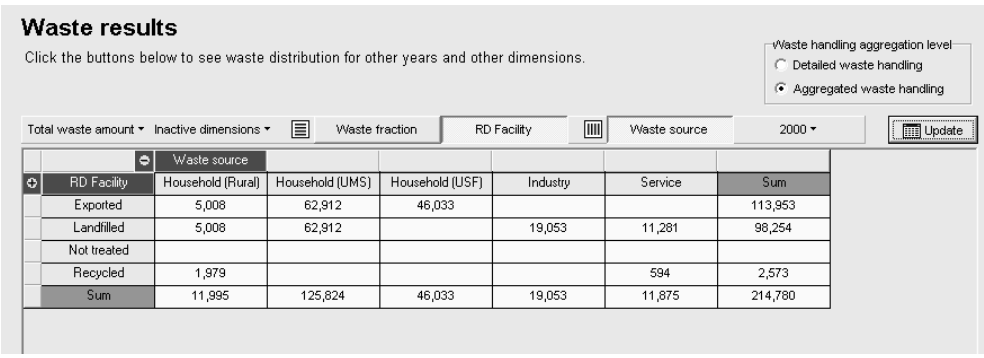


The table shows the share of packaging waste for different waste fractions (share of generated and collected waste). Initially, the table contains the default values. The default values for share of packaging waste are estimates based on data from Denmark and Poland. These values may be changed to reflect the current situation in the current municipality.

7.10 Waste Flow Results

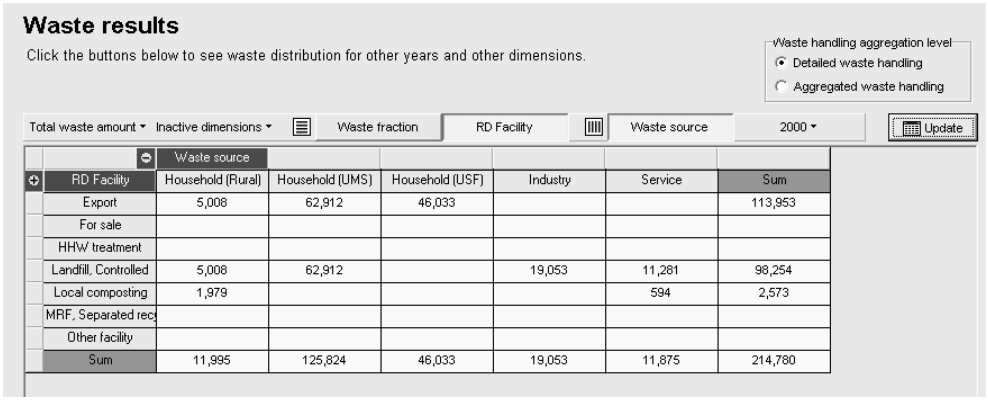
Waste flow

This screen shows a flexible cross-tabulation of the waste flow in the current municipality. The waste amounts shown include waste collected (but not waste not collected).



By default, the screen shows the amount of waste grouped by waste handling and waste source for the base year (here, 2000).

To see waste grouped by recovery and disposal technologies, click the Detailed waste handling field in the upper right corner and then the Update button. This will activate the following result table.



Waste results

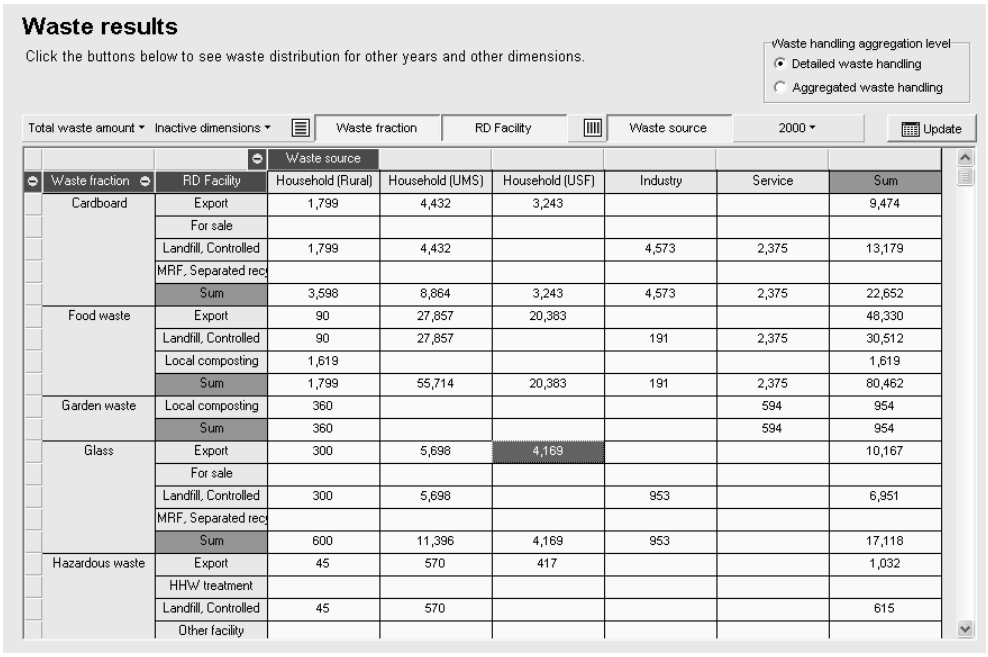
Click the buttons below to see waste distribution for other years and other dimensions.

Waste handling aggregation level
- (•) Detailed waste handling
- ( ) Aggregated waste handling

Total waste amount | Inactive dimensions | Waste fraction | RD Facility | Waste source | 2000 | Update

	Waste source					
RD Facility	Household (Rural)	Household (UMS)	Household (USF)	Industry	Service	Sum
Export	5,008	62,912	46,033			113,953
For sale						
HHW treatment						
Landfill, Controlled	5,008	62,912		19,053	11,281	98,254
Local composting	1,979				594	2,573
MRF, Separated rec						
Other facility						
Sum	11,995	125,824	46,033	19,053	11,875	214,780

By default, waste fraction and RD facility are available for row headers, while waste source and year are available for column headers. E.g. clicking the Waste fraction button would create a table with waste fraction and RD facility as row headers.



Waste results

Click the buttons below to see waste distribution for other years and other dimensions.

Waste handling aggregation level
- (•) Detailed waste handling
- ( ) Aggregated waste handling

Total waste amount | Inactive dimensions | Waste fraction | RD Facility | Waste source | 2000 | Update

		Waste source					
Waste fraction	RD Facility	Household (Rural)	Household (UMS)	Household (USF)	Industry	Service	Sum
Cardboard	Export	1,799	4,432	3,243			9,474
	For sale						
	Landfill, Controlled	1,799	4,432		4,573	2,375	13,179
	MRF, Separated rec						
	Sum	3,598	8,864	3,243	4,573	2,375	22,652
Food waste	Export	90	27,857	20,383			48,330
	Landfill, Controlled	90	27,857		191	2,375	30,512
	Local composting	1,619					1,619
	Sum	1,799	55,714	20,383	191	2,375	80,462
Garden waste	Local composting	360				594	954
	Sum	360				594	954
Glass	Export	300	5,698	4,169			10,167
	For sale						
	Landfill, Controlled	300	5,698		953		6,951
	MRF, Separated rec						
	Sum	600	11,396	4,169	953		17,118
Hazardous waste	Export	45	570	417			1,032
	HHW treatment						
	Landfill, Controlled	45	570				615
	Other facility						

It is possible to select which dimensions should be row or column headers. To move one dimension from row header to column header, right-click the relevant dimension end select Move to column area.

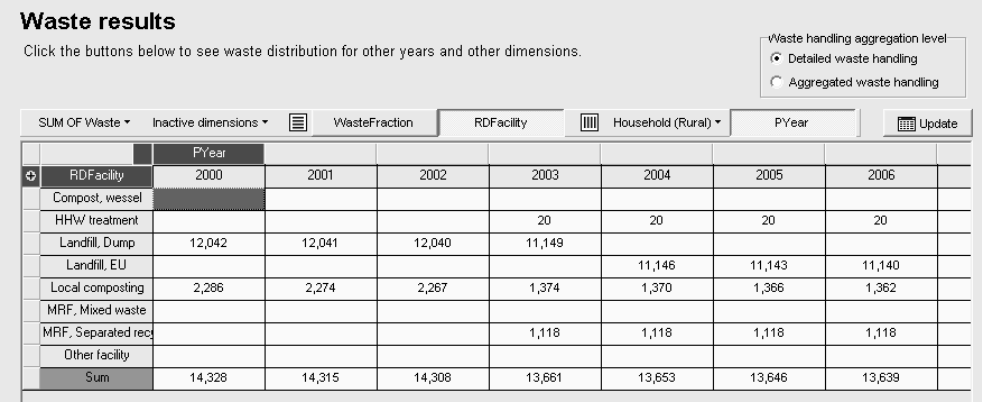
To see time series, click the 2000 button and select Open dimension.

To filter by a specific group value, right-click the relevant value and select Drill in to this value.

Example: We want to see a time series for waste from rural households.

- Right-click Household (Rural) in the column header
- Select Drill in to this value
- Click the 2000 button right above the table
- Select Open dimension

This will result in the following screen:



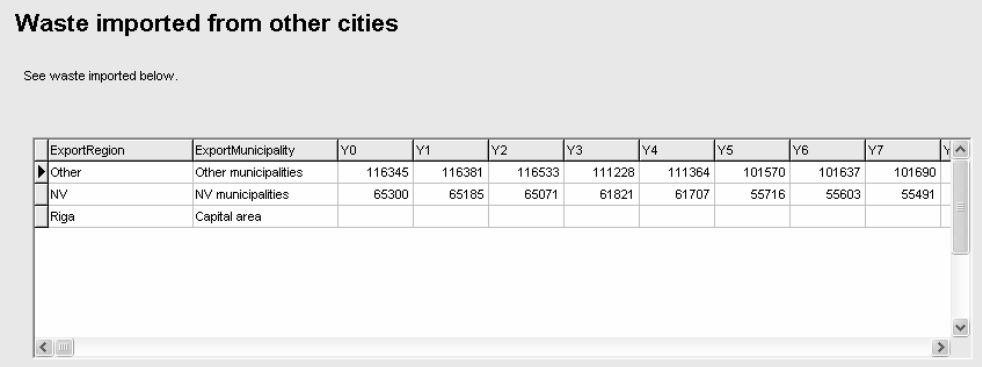
RDFacility \ PYear	2000	2001	2002	2003	2004	2005	2006
Compost, wessel							
HHW treatment				20	20	20	20
Landfill, Dump	12,042	12,041	12,040	11,149			
Landfill, EU					11,146	11,143	11,140
Local composting	2,286	2,274	2,267	1,374	1,370	1,366	1,362
MRF, Mixed waste							
MRF, Separated rec				1,118	1,118	1,118	1,118
Other facility							
Sum	14,328	14,315	14,308	13,661	13,653	13,646	13,639

To export data to Excel, right-click the part of the table containing data and select Copy to clipboard. Then go to Excel and paste the results into an existing spreadsheet (using Ctrl+v).

7.11 Waste Imported

Import

This screen shows the total amount of waste (in tonnes) imported from other municipalities to the current municipality.



ExportRegion	ExportMunicipality	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
Other	Other municipalities	116345	116381	116533	111228	111364	101570	101637	101690
NV	NV municipalities	65300	65185	65071	61821	61707	55716	55603	55491
Riga	Capital area								

7.12 Waste Recovery

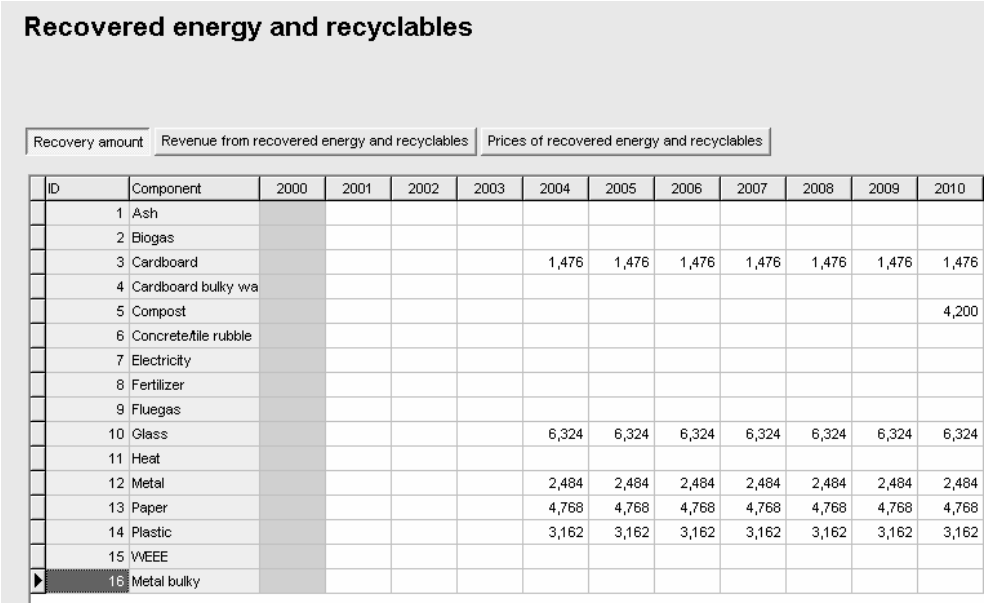
Recovered

This screen shows the waste recovery, local prices of energy and recyclables and revenue from waste recovery. The screen contains three sub-screens.

- *Recovery amount* shows the amount of energy and recyclables from the current municipality calculated by FEASIBLE.
- *Revenue from recovered energy and recyclables* shows the revenue calculated by FEASIBLE.
- *Prices of recovered energy and recyclables* allows entry of local prices of recovered materials and energy

Recovery amount

This screen shows the amount of energy and recyclables from the current municipality.

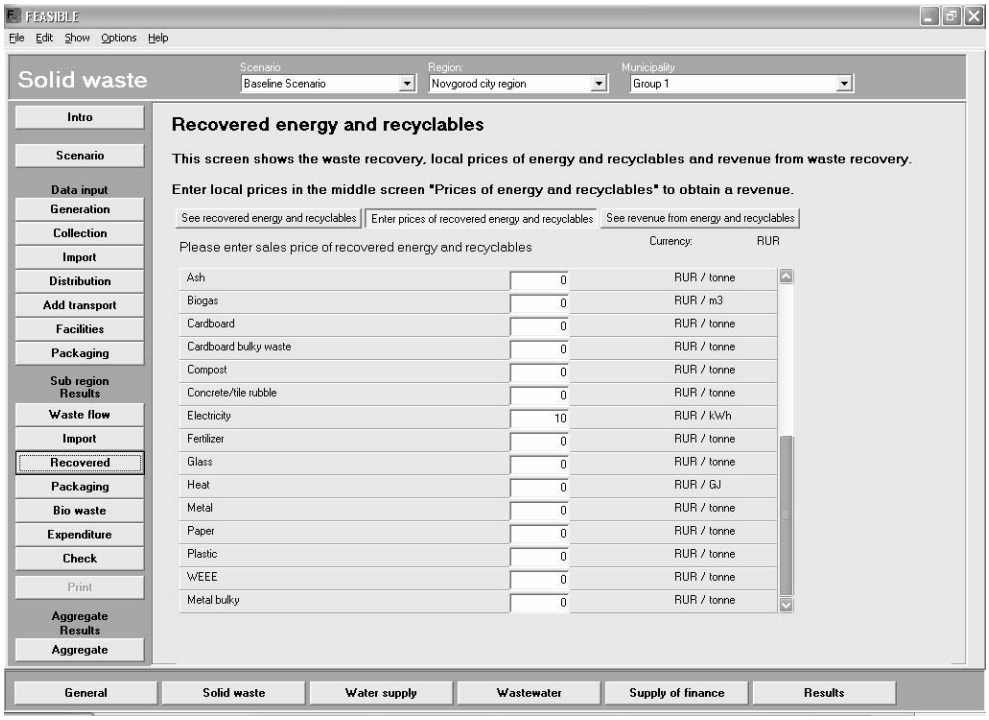

Recovered energy and recyclables
Recovery amount
Revenue from recovered energy and recyclables
Prices of recovered energy and recyclables

ID	Component	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1	Ash											
2	Biogas											
3	Cardboard					1,476	1,476	1,476	1,476	1,476	1,476	1,476
4	Cardboard bulky wa											
5	Compost											4,200
6	Concrete/tile rubble											
7	Electricity											
8	Fertilizer											
9	Fluegas											
10	Glass					6,324	6,324	6,324	6,324	6,324	6,324	6,324
11	Heat											
12	Metal					2,484	2,484	2,484	2,484	2,484	2,484	2,484
13	Paper					4,768	4,768	4,768	4,768	4,768	4,768	4,768
14	Plastic					3,162	3,162	3,162	3,162	3,162	3,162	3,162
15	WEEE											
16	Metal bulky											

Most of the units are tonnes except for electricity which is measured in kWh, biogas which is measured in $m^{3,}$ and heat which is measured in GJ.

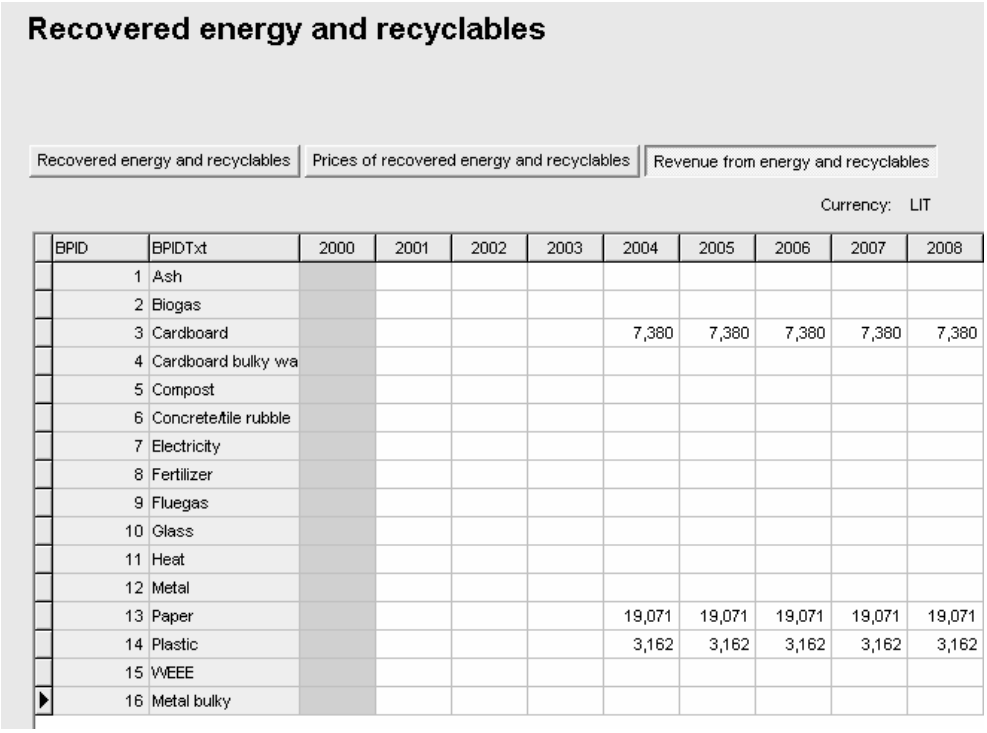
Prices of recovered energy and recyclables

This screen shows the (local) prices of recovered energy and recyclables for the current municipality. Enter the sales prices of recovered energy and recyclables in local currency. By default, the prices are set at 0 meaning that there will be no revenue unless specific values are entered.



Revenue from recovered energy and recyclables

This screen shows the revenue from recovered energy and recyclables. The results in the table have been generated by multiplying the amounts by the prices specified by the user. The revenue is subtracted from the operation and maintenance expenditure when the expenditure is transferred to the general result component. However, the revenue has its own expenditure line in the solid waste module expenditure overview screen which shows the total amount of revenue from each municipality in the model and enables comparison with the other expenditure components from this municipality.


Recovered energy and recyclables
Recovered energy and recyclables
Prices of recovered energy and recyclables
Revenue from energy and recyclables
Currency: LIT

BPID	BPIDTxt	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	Ash									
2	Biogas									
3	Cardboard					7,380	7,380	7,380	7,380	7,380
4	Cardboard bulky wa									
5	Compost									
6	Concrete/tile rubble									
7	Electricity									
8	Fertilizer									
9	Fluegas									
10	Glass									
11	Heat									
12	Metal									
13	Paper					19,071	19,071	19,071	19,071	19,071
14	Plastic					3,162	3,162	3,162	3,162	3,162
15	WEEE									
16	Metal bulky									

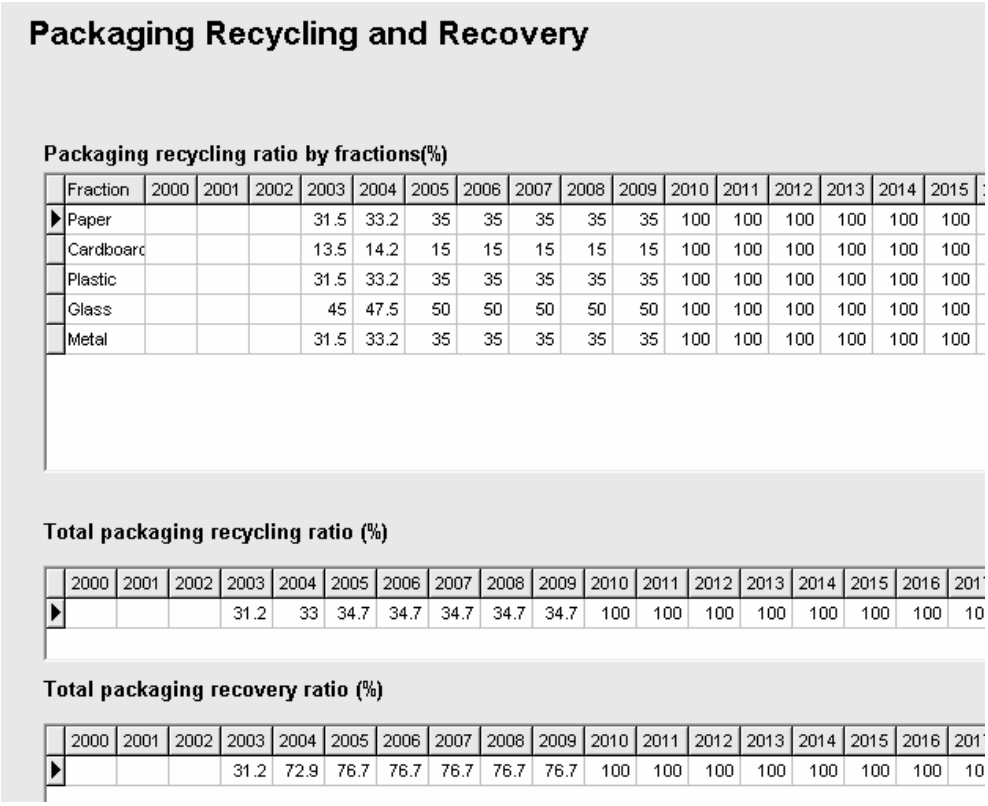
7.13 Packaging Waste Results

Packaging

This screen shows packaging waste indicators for the current municipality.

Two types of packaging waste indicators are shown for the planning period.

- *Packaging recycling ratio.* The share of packaging waste sent to recycling facilities in total amount o packaging waste generated.
- *Packaging recovery ratio*. The share of packaging waste sent to recycling facilities or to incineration plants with energy recovery (Type A and B) in total amount of packaging waste generated.



Packaging Recycling and Recovery

Packaging recycling ratio by fractions(%)

Fraction	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Paper				31.5	33.2	35	35	35	35	35	100	100	100	100	100	100
Cardboard				13.5	14.2	15	15	15	15	15	100	100	100	100	100	100
Plastic				31.5	33.2	35	35	35	35	35	100	100	100	100	100	100
Glass				45	47.5	50	50	50	50	50	100	100	100	100	100	100
Metal				31.5	33.2	35	35	35	35	35	100	100	100	100	100	100

Total packaging recycling ratio (%)

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	201
			31.2	33	34.7	34.7	34.7	34.7	34.7	100	100	100	100	100	100	100	10

Total packaging recovery ratio (%)

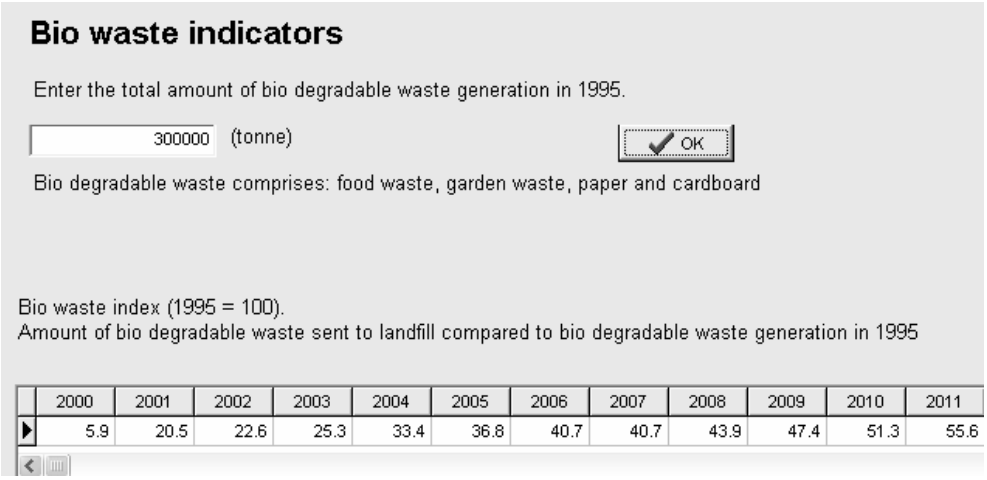
2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	201
			31.2	72.9	76.7	76.7	76.7	76.7	76.7	100	100	100	100	100	100	100	10

7.14 Biodegradable Waste Results

Bio waste

This screen shows the biodegradable waste indicator for the current municipality.

The biodegradable waste indicator shows the amount of biodegradable waste sent to a landfill as a share of the total amount of bio degradable waste generated in 1995.



Bio waste indicators

Enter the total amount of bio degradable waste generation in 1995.

300000 (tonne) OK

Bio degradable waste comprises: food waste, garden waste, paper and cardboard

Bio waste index (1995 = 100).
Amount of bio degradable waste sent to landfill compared to bio degradable waste generation in 1995

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
5.9	20.5	22.6	25.3	33.4	36.8	40.7	40.7	43.9	47.4	51.3	55.6

To calculate this indicator, enter the total amount of bio degradable waste generated in 1995 and click OK.

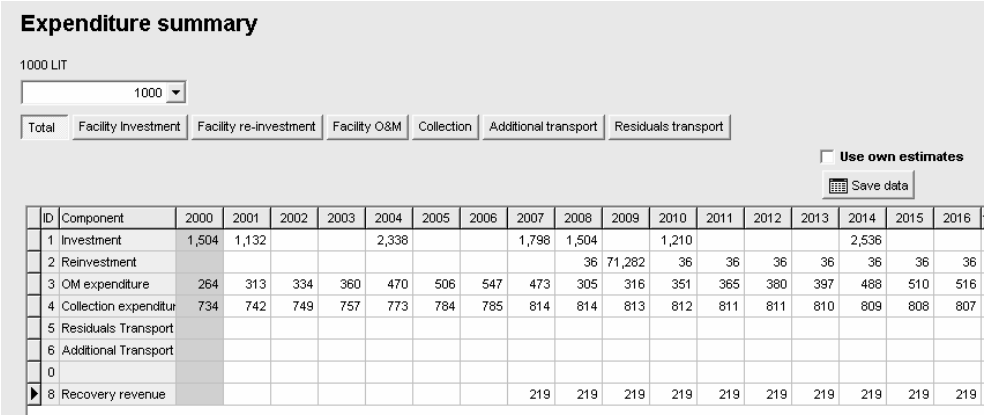
7.15 Expenditure Results

Expenditure

This screen shows the expenditure for the current municipality. The first screen shows a summary of the expenditure, whereas the remaining screens show the different types of expenditure in more detail.

- Total
- Facility investments
- Facility re-investments
- Facility operation and maintenance expenditure
- Collection expenditure
- Additional transport expenditure
- Residuals transport expenditure

The Total screen shows the summary expenditure.



ID	Component	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1	Investment	1,504	1,132			2,338			1,798	1,504		1,210				2,536		
2	Reinvestment									36	71,282	36	36	36	36	36	36	36
3	OM expenditure	264	313	334	360	470	506	547	473	305	316	351	365	380	397	488	510	516
4	Collection expenditur	734	742	749	757	773	784	785	814	814	813	812	811	811	810	809	808	807
5	Residuals Transport																	
6	Additional Transport																	
0																		
8	Recovery revenue								219	219	219	219	219	219	219	219	219	219

In the upper left corner of the screen, the unit and the currency of the expenditure are shown . The unit may be changed to make the table more readable.

To make these expenditure figures available in the general module, click the Save data button in the upper right corner of the screen whereby the data in the total table will be transferred to the general module.

In this screen, it is possible to overrule the expenditure figures calculated by FEASIBLE. To do so

- Mark the Use own estimates field (as long as this field is marked, the module will not overwrite the data entered by the user. When the field is unmarked, the figures in the table will be overwritten by expenditure figures calculated by FEASIBLE at the next update)

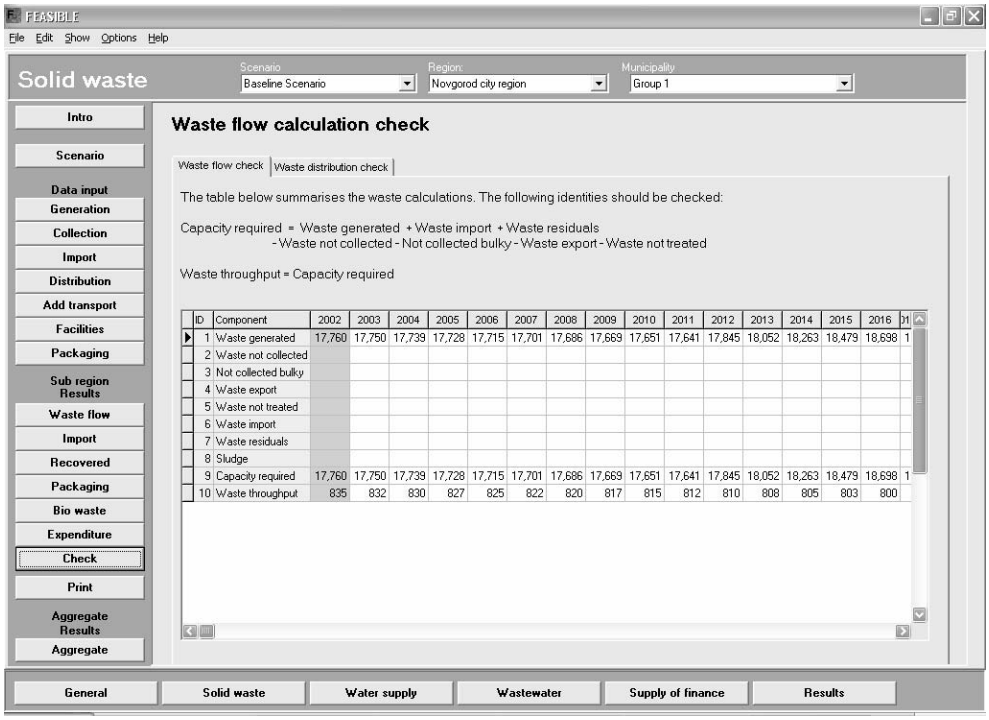
- Enter/change data where needed

- Click the Save data button.

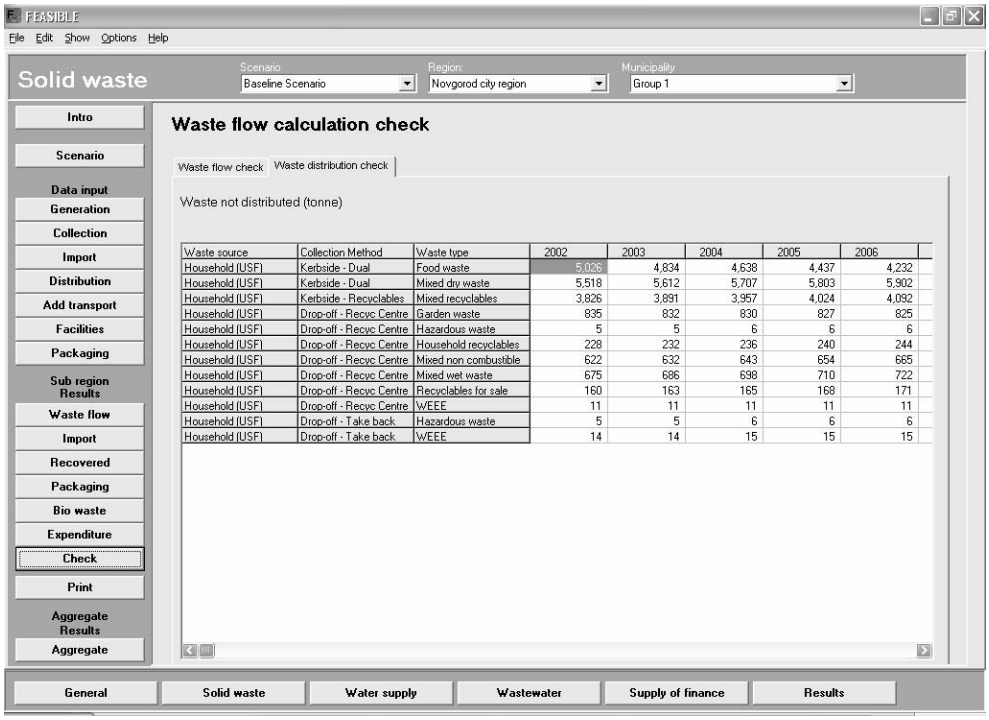
7.16 Check Waste Flow Consistency

Check

Waste flow check shows the waste flow calculated by FEASIBLE for the current municipality, which makes it possible to check the consistency of calculation.



Waste distribution check screen allows the user to make sure that all waste in the model has been distributed to relevant RD facility. The table shows waste not distributed. That is, if the data input is correct this table should be empty.


FEASIBLE
File Edit Show Options Help
Solid waste
Scenario
Baseline Scenario
Region
Novgorod city region
Municipality
Group 1
Intro
Scenario
Data input
Generation
Collection
Import
Distribution
Add transport
Facilities
Packaging
Sub region Results
Waste flow
Import
Recovered
Packaging
Bio waste
Expenditure
Check
Print
Aggregate Results
Aggregate
Waste flow calculation check
Waste flow check
Waste distribution check
Waste not distributed (tonne)
Waste source | Collection Method | Waste type | 2002 | 2003 | 2004 | 2005 | 2006
Household (USF) | Kerbside - Dual | Food waste | 5,026 | 4,834 | 4,638 | 4,437 | 4,232
Household (USF) | Kerbside - Dual | Mixed dry waste | 5,518 | 5,612 | 5,707 | 5,803 | 5,902
Household (USF) | Kerbside - Recyclables | Mixed recyclables | 3,826 | 3,891 | 3,957 | 4,024 | 4,092
Household (USF) | Drop-off - Recyc Centre | Garden waste | 835 | 832 | 830 | 827 | 825
Household (USF) | Drop-off - Recyc Centre | Hazardous waste | 5 | 5 | 6 | 6 | 6
Household (USF) | Drop-off - Recyc Centre | Household recyclables | 228 | 232 | 236 | 240 | 244
Household (USF) | Drop-off - Recyc Centre | Mixed non combustible | 622 | 632 | 643 | 654 | 665
Household (USF) | Drop-off - Recyc Centre | Mixed wet waste | 675 | 686 | 698 | 710 | 722
Household (USF) | Drop-off - Recyc Centre | Recyclables for sale | 160 | 163 | 165 | 168 | 171
Household (USF) | Drop-off - Recyc Centre | WEEE | 11 | 11 | 11 | 11 | 11
Household (USF) | Drop-off - Take back | Hazardous waste | 5 | 5 | 6 | 6 | 6
Household (USF) | Drop-off - Take back | WEEE | 14 | 14 | 15 | 15 | 15
General
Solid waste
Water supply
Wastewater
Supply of finance
Results

7.17 Print Report

Click Print to produce a set of predefined reports for the current municipality.

7.18 Aggregate Results

This screen shows the overall waste flow results for waste collected (waste not collected is not included). It includes all scenarios and regions and, therefore, facilitates comparisons between scenarios and regions. The results available for this screen comprise.

- Waste flow (tonnes)
- Biodegradable waste indicator (according to the EU Landfill Directive) and
- Packaging waste indicators (according to the EU Packaging Directive).

Aggregate waste flow

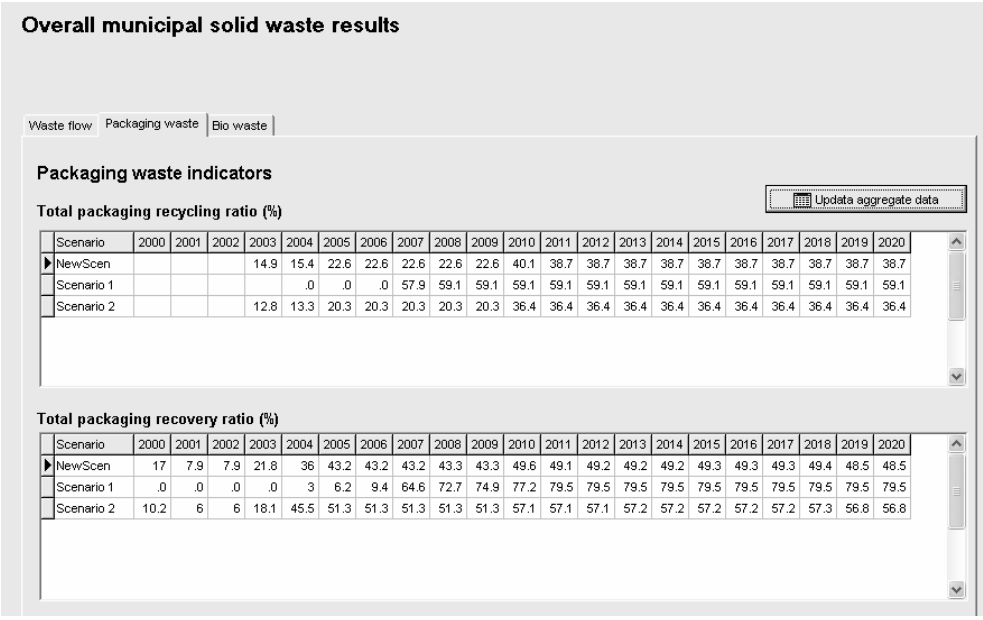
The waste flow screen is very similar to the waste flow screen for the current municipality (see section 7.10).

By default, waste export is excluded from the exporting municipality. However, to help the user check the overall waste flow and the consistency of the export-import calculations. it is possible to include export in the summary tables. To include export, check the include export checkbox and update the table by clicking the Update aggregate data button in the lower left corner of the screen.

Note, however, that this option will lead to double counting, since it will imply that exported waste is counted twice (if it is imported appropriately).

Packaging waste

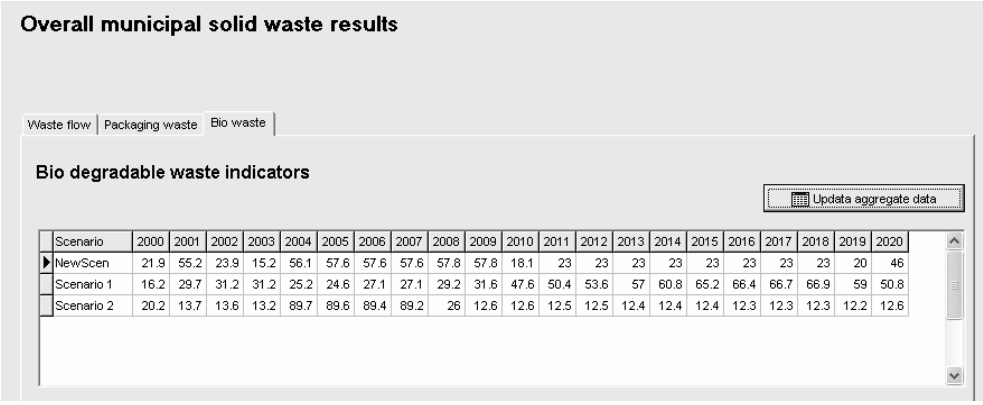
The packaging waste results screen is very similar to the packaging waste results screen for the current municipality (see section 7.13).



However, in this screen, the packaging waste is aggregated to the scenario level (comprising all regions and municipalities) to enable comparisons between scenarios.

Bio waste

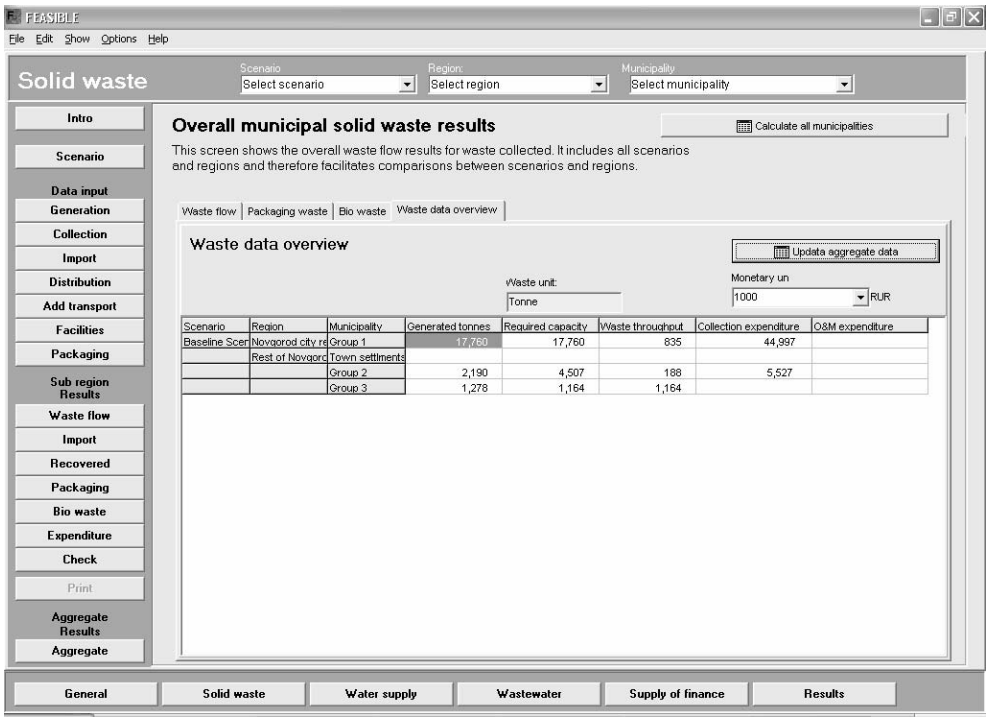
The same goes for the aggregate bio waste screen showing bio waste indicators at scenario level. This screen is similar to the screen shown in section 7.14.



Scenario	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
NewScen	21.9	55.2	23.9	15.2	56.1	57.6	57.6	57.6	57.8	57.8	18.1	23	23	23	23	23	23	23	23	20	46
Scenario 1	16.2	29.7	31.2	31.2	25.2	24.6	27.1	27.1	29.2	31.6	47.6	50.4	53.6	57	60.8	65.2	66.4	66.7	66.9	59	50.8
Scenario 2	20.2	13.7	13.6	13.2	89.7	89.6	89.4	89.2	26	12.6	12.6	12.5	12.5	12.4	12.4	12.4	12.3	12.3	12.3	12.2	12.6

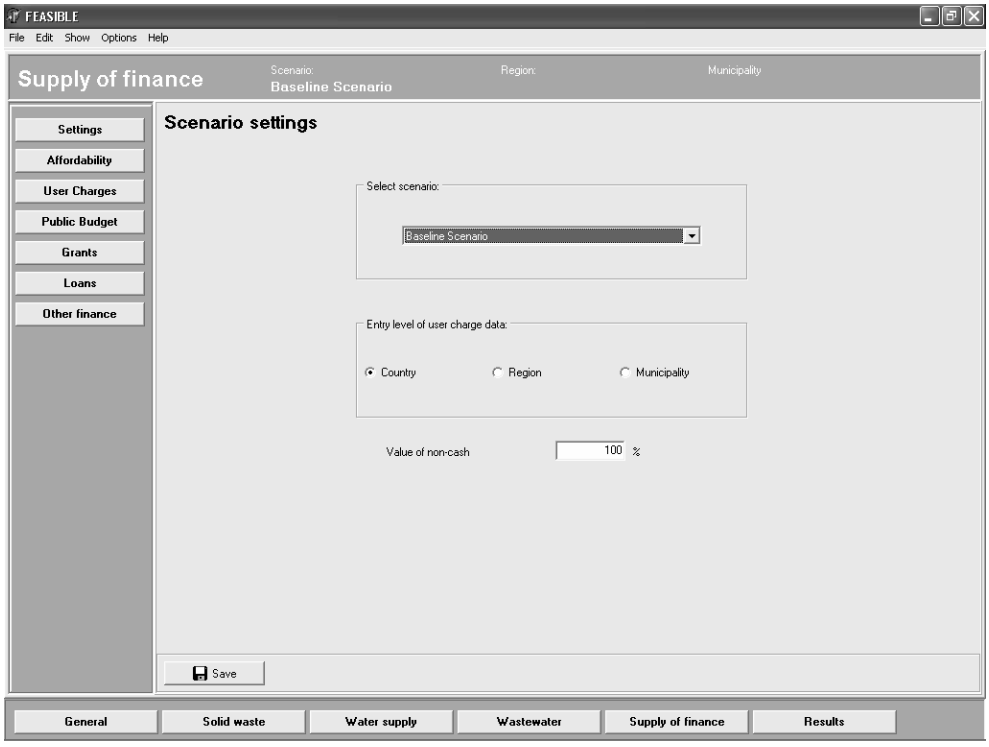
Waste data overview

This screen presents an overview of waste data by Scenario, Region, and Municipality.



8 User Manual - Supply of Finance

Opening the Supply of finance module displays the folder shown below. The user selects scenario and then decides at what spatial level the input on user charges should be made. User charges can be specified for each municipality, for each region or just as a total for the whole application area.

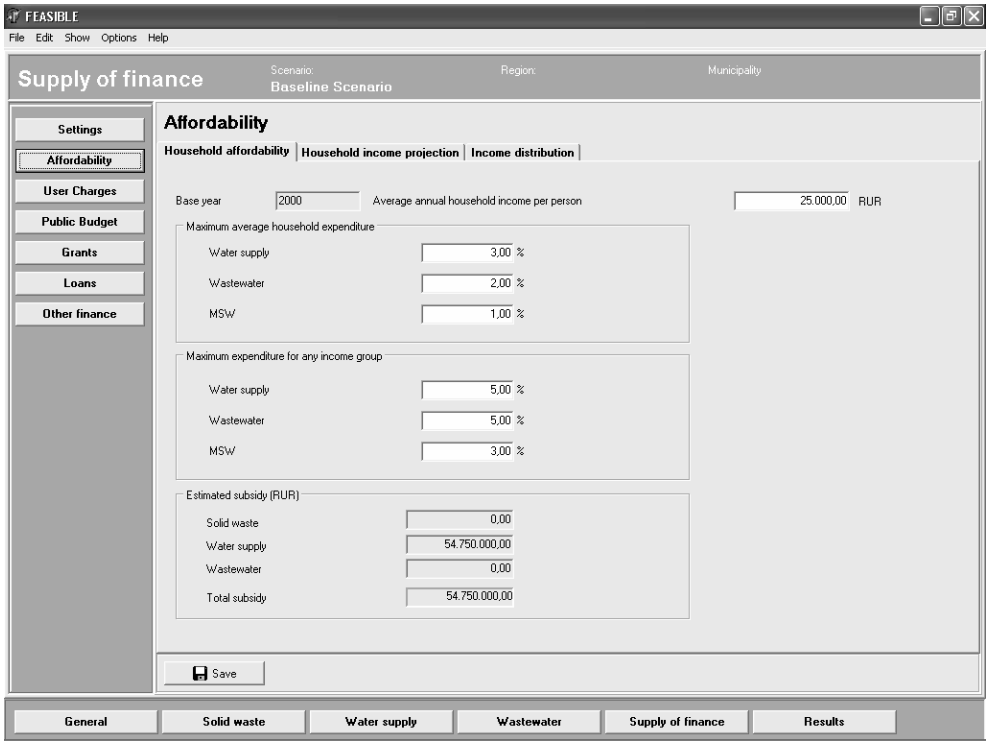


The input data on user charges will be given at regional or country level and grants and loans can also only be specified at that aggregation level. However, if user charges are specified for each municipality, it is still possible to specify grants and loans at the regional or national levels. Also, input on public budget supply of finance follows the aggregation level of user charges, except that it cannot be more detailed than regional level data.

8.1 Affordability

The affordability folder requires input on average annual household income specified in the national currency and as per capita.

The affordability limits are given as the maximum share of household income to be spend on each of the three sectors.

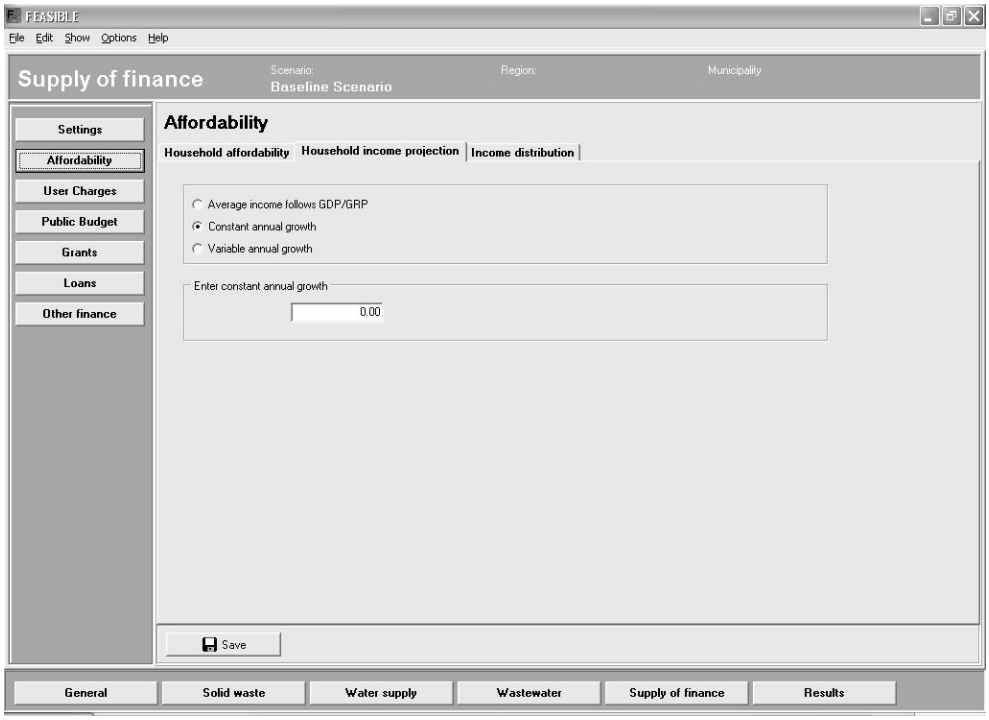


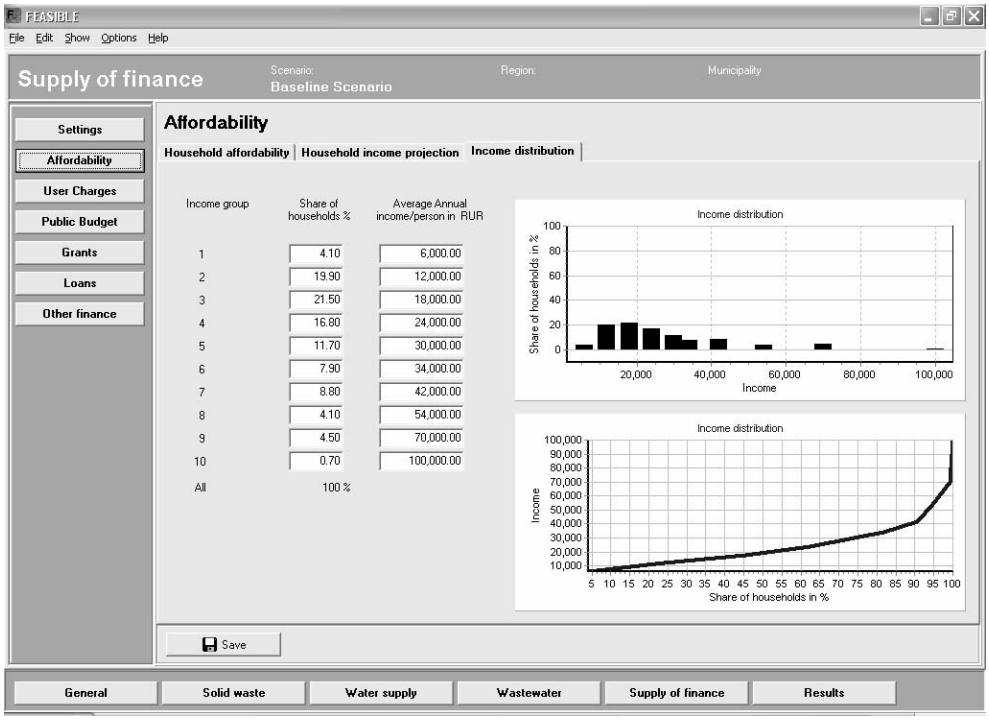
Below these entries, it is possible to specify a maximum share that should apply for any income group. These values are used to estimate the need for subsidisation of the poorest households. If the maximum affordable level is specified as 2% of *average* income for water supply, it might result in spending of 8% for the poorest. If the second maximum limit is set to 5 % for any income level, the result is that a subsidy of 3% of the household income is necessary for the poorest. The total need for subsidies, given the specified maximum expenditures data, is calculated and display the bottom of the screen.

On the next two sub-folders data on household income projection and distribution is given.

Household income may be specified to be constant, to follow the GDP projection or by entering a specific growth profile.

In the income distribution sub-screen, the second column, the average income person in each group, should be specified as the medium value in an income bracket, e.g. average income of 50, 150, 250, 350, etc. representing income brackets in the ranges 0 to 100, 101 to 200, etc. Then the percentage of population within each income bracket should be given.





8.2 User Charges

The user charge data is entered for each sector and then for each region or municipality according the choice of spatial level of data specified in *Settings*.

There are three user groups:

- households;

- industry; and
- others.

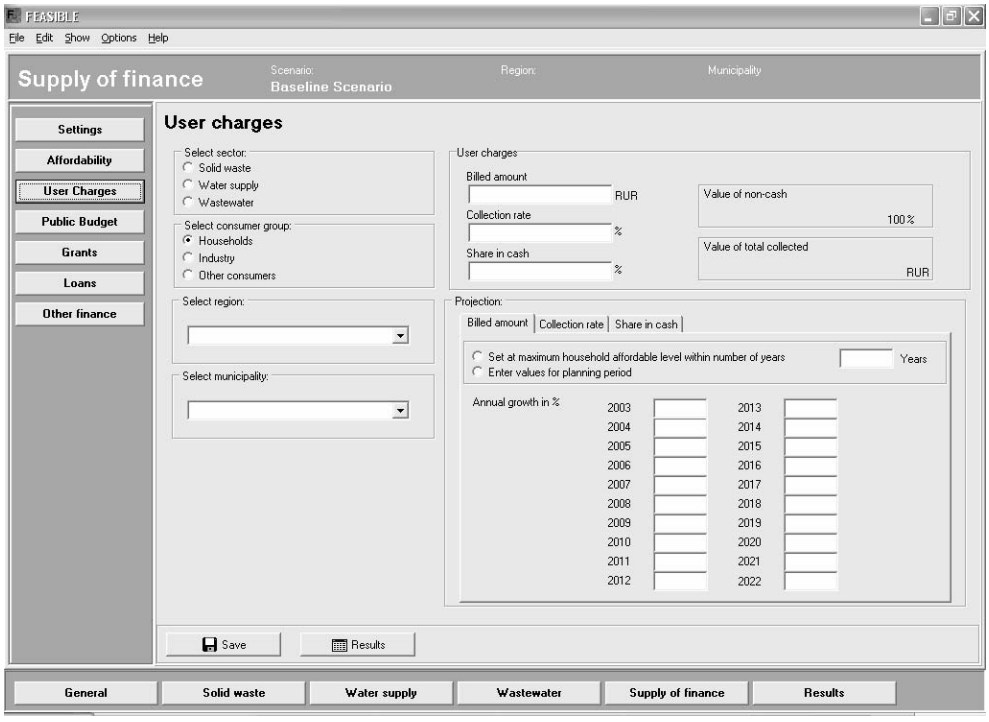
The groups are selected one by one, and data is inserted. *Billed amount* is the amount that this user group is supposed to pay. The format is total annual amount. The collection rate is the share of the billed amount that is actually paid. The share of cash is to allow for cases where not all the payment is made in the form of cash, check, bank transfers etc.

For each consumer group, the revenue is then calculated as:

*Billed amount * collection rate = collected revenue*

*Value of collected revenue = collected revenue *(share in cash + (1- share in cash)* value of non-cash payment).*

Analysis of the revenue from user charges will in most cases have to be made as a pre-model activity. If data on the total billed amount or the total collected revenue is available, they are generally to be preferred. Estimating revenue based on data for tariffs and amounts tends to overestimate the total revenue as a number of domestic consumers usually pay less than the published tariff. There may be many reasons for this. In the former Soviet, there is a plethora of privileges etc. given to individual user groups and as a result the "effective" billed amounts are typically much lower than the published tariffs (before privileges) indicate.



The projection of the user charge revenue comprises the three elements

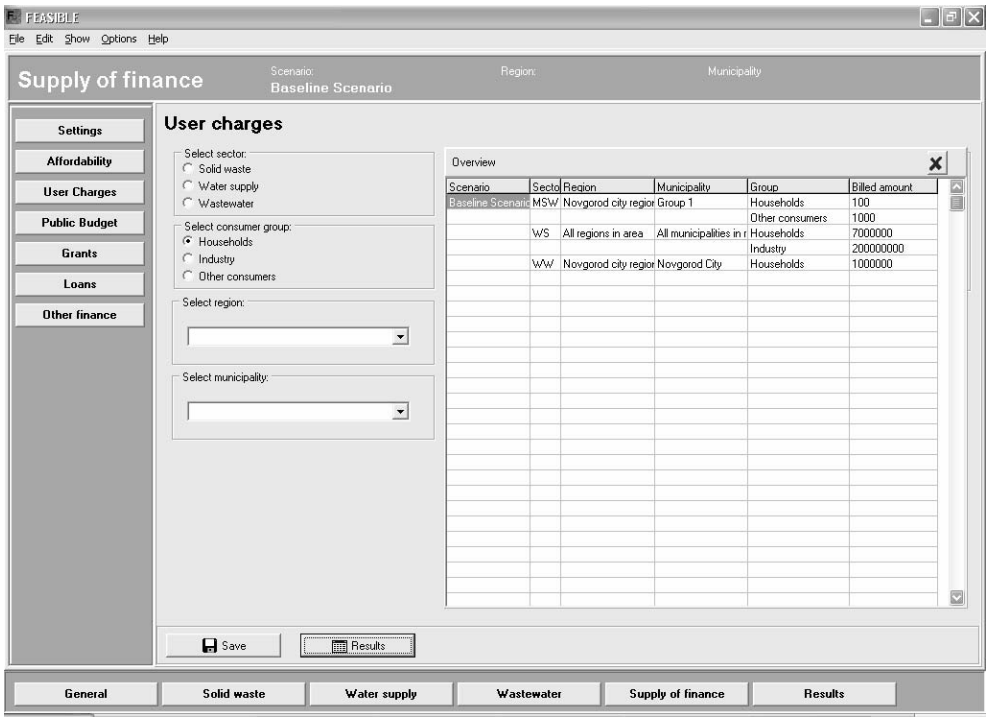
- billed amount

- collection rate and
- share in cash.

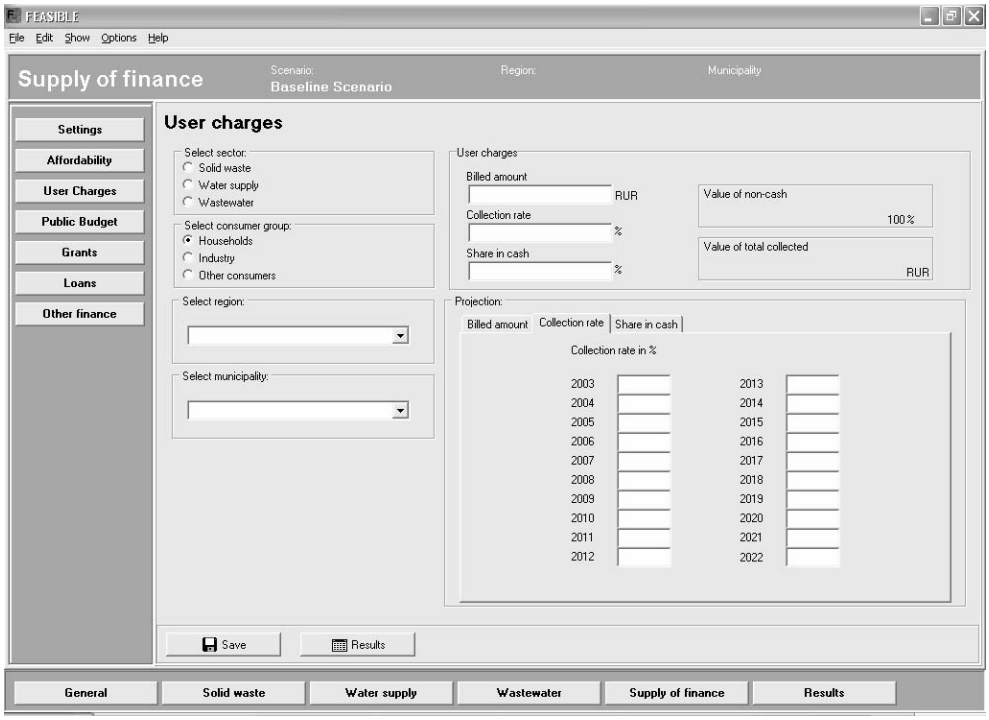
For households, the billed amount may be projected either by specifying that it has to reach the maximum affordable level with a given number of years (also to be specified). In that case, FEASIBLE will automatically project an increasing amount which, after reaching the maximum affordable share of the average income, will follow the projection of the income.

Alternatively, a growth profile may be entered by specifying the year-by-year increase in the billed amount. (A 5% increase is entered as "5").

By pressing the button *Results* summary calculations of this screen are presented.



The collection rate has to be specified as a value between 0 or 100. Share of cash has the same format. However, the value of cash, specified in *Supply of finance, Settings*, has the value of 100%, there is no revenue effect of giving the input on share of cash and it can be omitted for convenience.



8.3 Public Budget

Enter public budget data for either the whole application area or for each region. If user charges are given for the whole application area (called country level), the public budget data should be specified at the same aggregation level. The estimation and projection of the public budget contribution is based on the GDP/GRP data.

Start by Selecting *region.* Then, choose between absolute or percentage input. In order to enter data for the public budget contribution, a number of steps are required according to the structure described below.

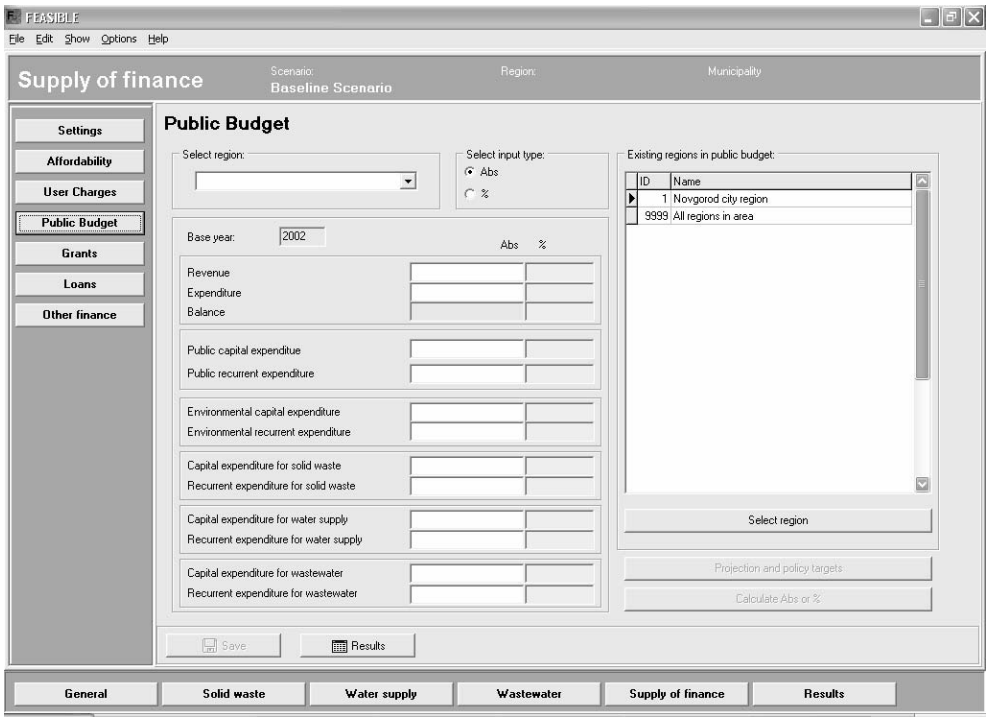
Firstly, enter data on total public revenue and expenditure is required and then total public capital and current expenditure. If the data is based on percentages, it is important to note that the percentage specified refers to the relevant previous category. For example, if a percentage value is entered for public capital expenditure, FEASIBLE will, when filling in the column with absolute values, take that percentage of the total public expenditure. If a percentage value for environmental capital expenditure is entered, reference will be made to the total capital expenditure.

The needed data on total public revenue, expenditure and capital and current expenditure can, in most cases, be found in regional public accounts. The term environmental expenditure may, however, not correspond to any figure that appears in the public accounts. This item may be understood as a reference expenditure category, meaning that the user will have to define an appropriate category which could be total expenditure on municipal services.

The benefit of this category lies in the possibility of policy analysis. That is to analyse questions such as what is the effect of increasing the share of public budget expenditure allocated to the environmental sectors included here, water supply, wastewater and municipal solid waste.

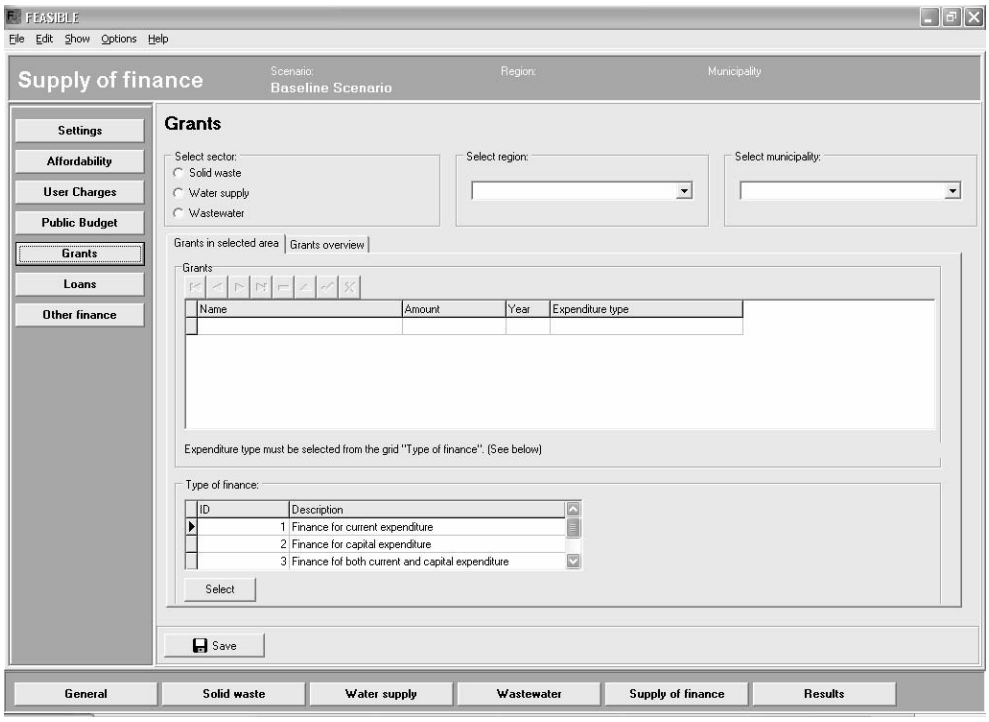
If specific data on the allocation to the sectors is available and the user has no interest in the extended policy analysis, the absolute values can be entered backwards. In that case, data for the more aggregated category can be given merely as the sum of the specific sector data. FEASIBLE will then calculate the percentage values needed for the projection.

Having entered the data, press *Calculate Abs or %* to fill in the complementary data. Activate *Projection and policy targets* to open a new screen. In this screen, the shares (percentages) of all the steps of analysing the public budget contribution have to be filled in. After that press *Return* to go to previous screen.



Button *Results*, as usual, will present summary results for this screen calculations.

8.4 Grants

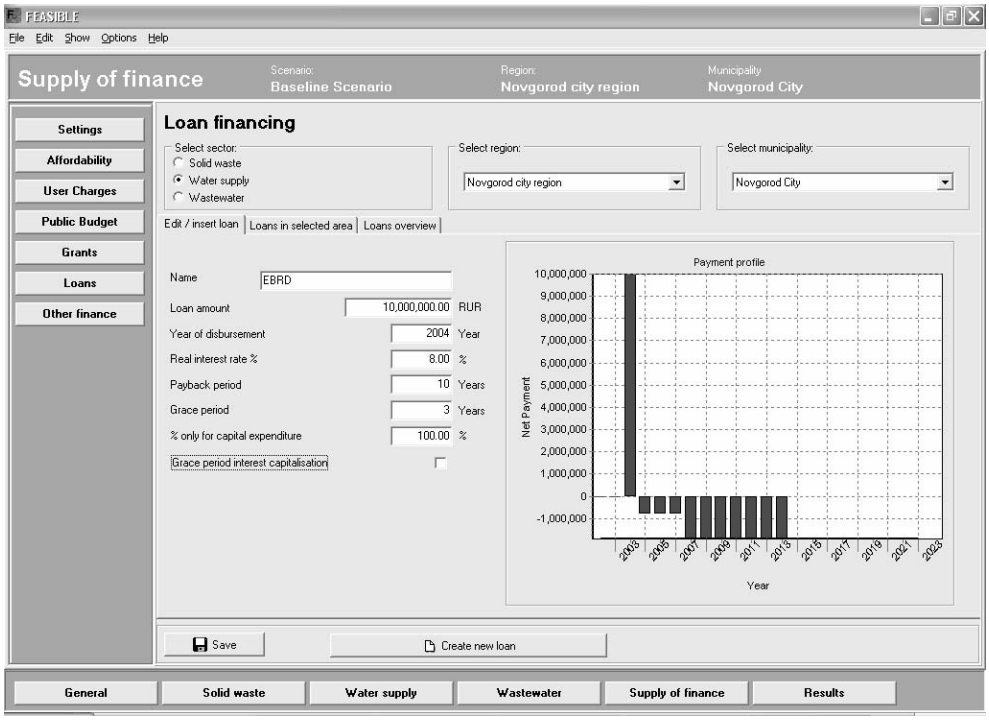


Grants have to be specific for a sector, whereas there is full flexibility for regions and municipalities. A grant may be assign to a specific municipality within a region. This done by selecting *All municipalities in region* from the list displayed when activating the drop-down menu *Select Municipality*.

The data to be entered to define grants comprises name of the grant, the amount in national currency, the year of disbursement and the type of expenditure for which it can be used. The last choice is made by selecting one of the three options form the list, *Type of finance*.

8.5 Loans

The sector and geographical assignment of loans follow the same principles as explained for grants.



Enter the loan characteristics and see the resulting cash-flow profile. If more than one loan is entered, in the *Loan overview* screen, the loans can be seen and selected for modification in the first sub-screen.

8.6 Other Finance (Optional)

Other Finance is an optional facility covering finance that cannot be group among the types of finance previously described. If for example, individual municipalities provide operational subsidies, they could be entered here.

The format of the data is similar to that concerning grants.

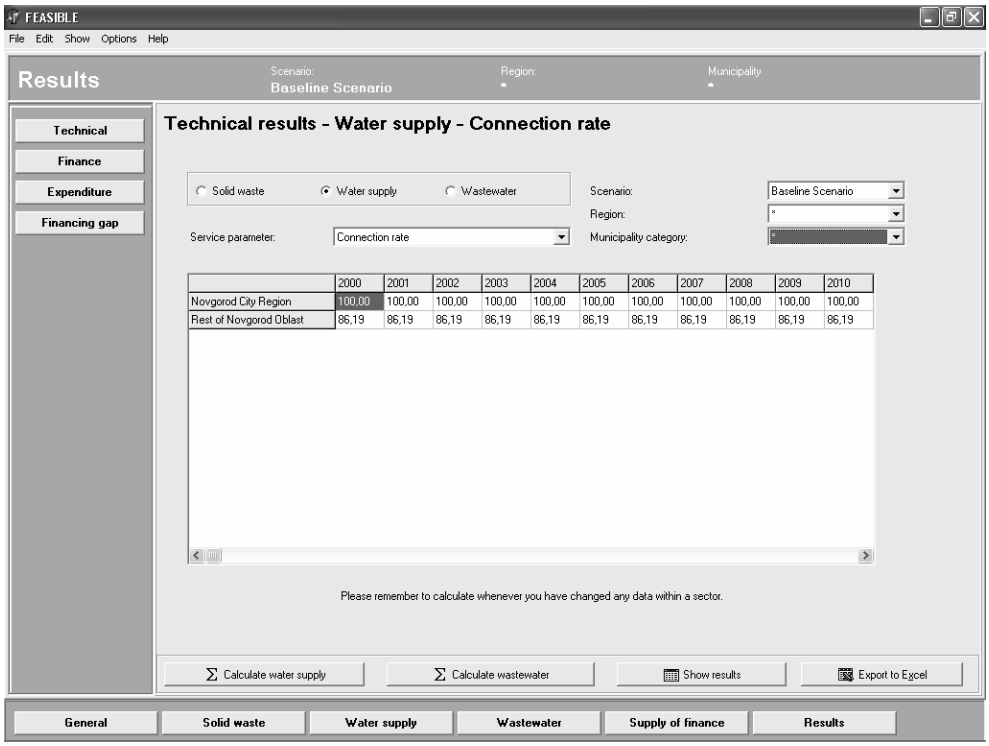
9 User Manual - Results

The *Result* component comprises four main screens:

- Technical results;
- Finance;
- Expenditure; and
- Financing gap.

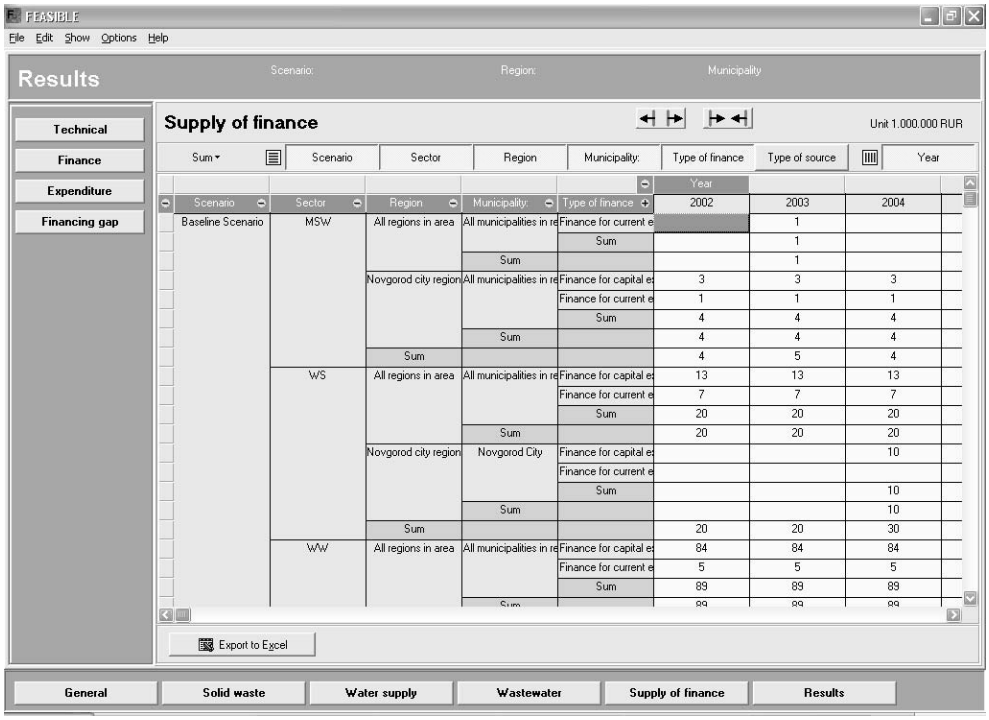
9.1 Technical Results

The technical results folder provides a selected number of service parameters and other non-expenditure characteristic. Here, it is possible to see aggregated values. While all these parameters can been seen for each municipality one by one (many are direct input specified by the user) at the sector module, aggregated values are displayed here for the water supply and the wastewater sector. Technical results for municipal solid waste are shown within the solid waste module.



9.2 Finance (Supply of Finance Results)

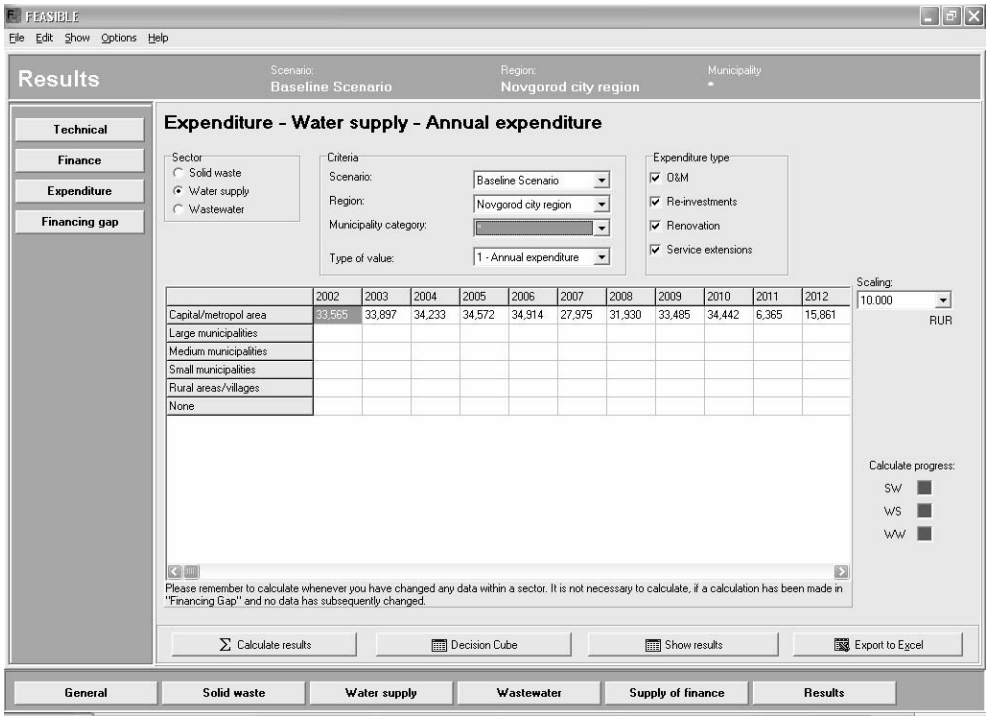
In the *supply of finance* screen, select the scaling factor and then activate the *Show results* button to activate a table in which a combination of results may be specified. Two arrow buttons allow to manipulate column width in order to see full overview on the screen.



9.3 Expenditure

The *Expenditure* screen offers two types of layout for viewing the result. In any case, start by selecting sector, scenario, region, municipality category and annual or accumulated expenditure.

Having made this selection, the results are displayed in the table. It is also possible to activate the *Decision Cube* button to show a more flexible table format.



9.4 Financing Gap

The procedure to open the *financing gap* tables is similar to that described above for expenditure tables.

FEASIBLE
File Edit Show Options Help
Results
Scenario:
Baseline Scenario
Region:
Novgorod city region
Municipality
*
Technical
Finance
Expenditure
Financing gap
Financing Gap
Unit 10.000 RUR
Gap
Scenario
Sector
Region
Mun. Category
Year
Spreadsheet
Graph
Baseline Scenario
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
-5,000
-10,000
-15,000
-20,000
-25,000
-30,000
Gap
2002 2003
2005 2006
2008 2009
2011 2012
2014
2016 2017
2019 2020
2022
Year
General
Solid waste
Water supply
Wastewater
Supply of finance
Results

Appendix 1: Documentation of Expenditure Functions – General

Appendix 2: Documentation of Expenditure Functions - Water Supply

Appendix 3: Documentation of Expenditure Functions - Wastewater

Appendix 4: Documentation of Expenditure Functions - Municipal Solid Waste

BIM

Appendix 5: Literature

Appendix 6: Glossary of Terms and Abbreviations